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# **DRAFT STORMWATER FACILITIES MAINTENANCE AND OPERATIONS MANUAL**

I-405 / SR 167 INTERCHANGE  
DIRECT CONNECTOR PROJECT

I-405, MP 2.32 to MP 3.96  
SR 167, MP 21.31 to MP 26.26

CONTRACT NO. C8811

**WASHINGTON STATE DEPARTMENT OF TRANSPORTATION**  
Northwest Region - Seattle, Washington



**Washington State  
Department of Transportation**



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# 1 INTRODUCTION

This Stormwater Facilities Maintenance and Operations Manual provides WSDOT Maintenance Crews with an overview of the drainage improvements implemented as part of the I-405 / SR 167 Direct Connector Project. The goal of this Manual is to provide the necessary coordination between the design-build team and WSDOT Maintenance Crews to ensure proper function and maintenance of constructed stormwater flow control and treatment facilities. The following sections provide a breakdown of the I-405 / SR 167 Direct Connector Project, including existing drainage features and locations, as well as proposed drainage facilities, locations, and suggested maintenance procedures.

## 1.1 PROJECT DESCRIPTION

The Washington State Department of Transportation (WSDOT) is currently completing a series of design-build (D-B) projects that will improve mobility and safety throughout the Interstate 405 (I-405) corridor from Interstate 5 (I-5) and I-405 interchange in Tukwila to the I-5 Swamp Creek Interchange in Lynnwood (MP 30.2). I-405 is the second-most traveled corridor in Washington carrying over 600,000 people and averaging up to 12 hours of gridlock every day. Currently, I-405 varies from six to ten lanes along the 30-mile corridor.

The **I-405/ SR 167 Interchange – Direct Connector Project** (Project) site is located on I-405 in the vicinity of the SR 167 and SR 515 interchanges within the City of Renton, Washington. The Project is part of the overall I-405 Tukwila to Renton Improvement Project.

The Project will construct a new direct connector ramp for a high occupancy vehicle (HOV)/express toll lane (ETL) in each direction between SR 167 south leg HOT lanes and I-405 north leg HOV lanes. Included is reconstructing sections of I-405 and SR 167 to open up the medians to make room for the new direct connector ramp; constructing a new HOV/ETL structure between SR 167 and I-405; widening/replacing the I-405 bridge over SR 515 (Bridge Number 405/16); and constructing new retaining walls. This project will modify local roadways, including S 14<sup>th</sup> Street, related to the interchange improvements and I-405/SR 167 widening; install sign bridges; install ITS and tolling; install/replace noise walls; construct storm water management facilities; and modify/replace an existing SR 167 stream crossing to improve fish passage. This project will also relocate two major utilities: Olympic underground pipeline and Seattle City Light overhead high voltage power lines.

The Project also includes paver construction along SR 167 from MP 21.31 to MP 24.80. There is no widening or change in hydraulic or hydrologic condition in this paver construction section.

As part of the Project improvements, WSDOT committed to environmental agencies to provide stormwater treatment following the current WSDOT Guidelines plus some retrofit as needed to meet specific water quality mitigation within the Project limits and will also



provide flow control for the new impervious surfaces created by the Project. Predevelopment condition is defined as historic condition following the HRM.

The project has been separated into four major threshold discharge areas (TDAs) by receiving water bodies: Panther Creek tributary to Springbrook Creek (TDA S2.1), Rolling Hills Creek that receives runoff through Culvert 48 and the ditches north of I-405 and drains south through the SW 19<sup>th</sup> Street tributary to Springbrook Creek (TDAs S2.2 and S2.3), and Thunder Hills Creek tributary to Rolling Hills Creek upstream of Talbot Road (TDA S2.4). There are two additional TDAs that include work associated with the project. These TDAs are identified as S1 and S3 in the I-405, I-5 to SR 169 Stage 1 Widening (Renton Stage 1) Hydraulic Report. The project does not increase stormwater or other environmental impacts within these TDAs. This memo documents the permanent hydraulic/hydrologic improvements, fish passage barriers, permanent erosion control measures, and the other related modifications to be constructed as a result of improvements to I-405 and SR 167 to manage the resulting change in stormwater discharge while protecting water quality. The hydraulic features include pipe collection systems, fish passage barriers, flow control ponds, media filter drains (MFD), and compost-amended biofiltration swales (CABS).

## **1.2 SITE LOCATION**

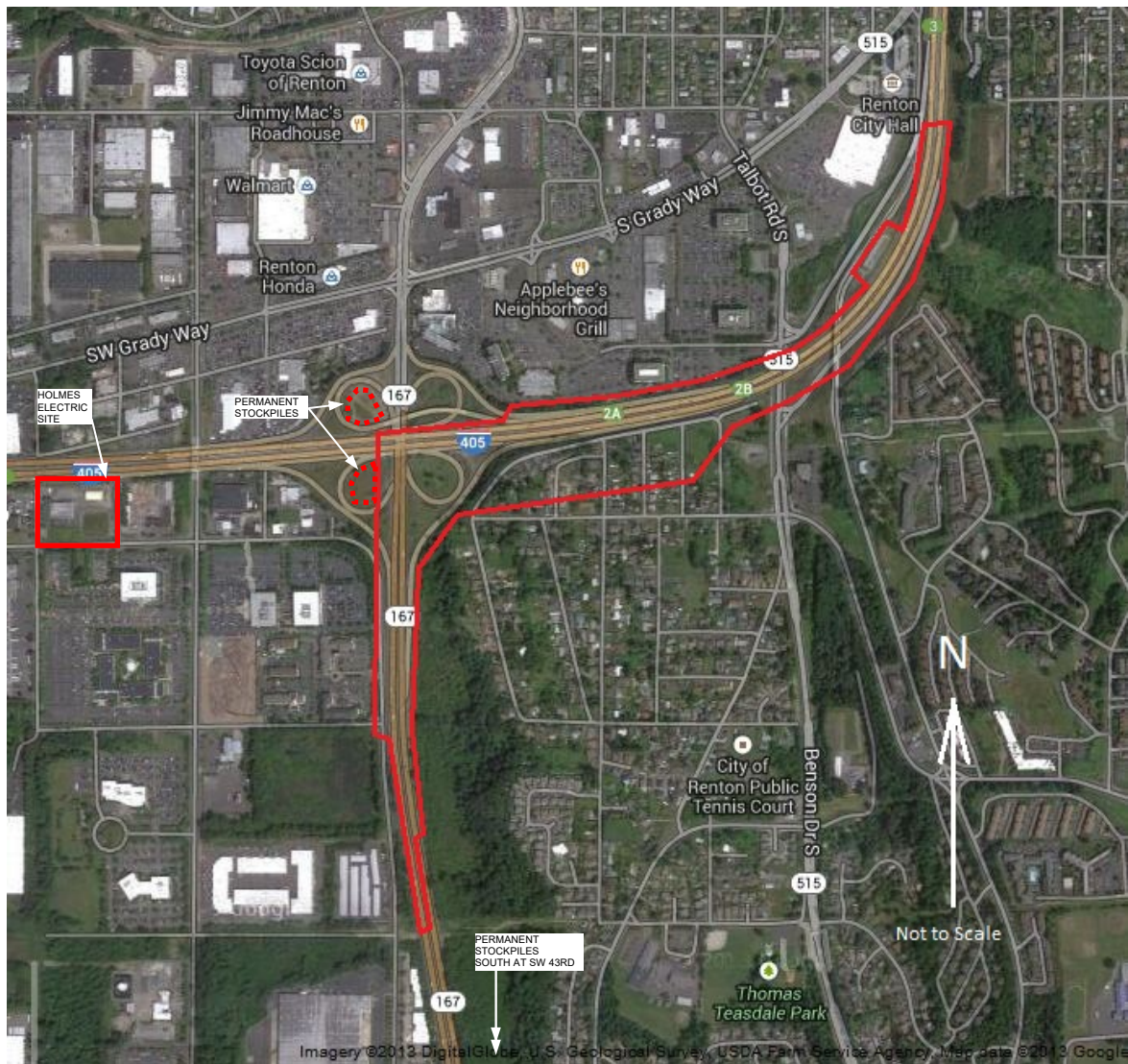
The Project is located along the I-405 corridor from SR 167 (MP2.32) to SR 169 (MP 3.96), within the incorporated limits of the City of Renton, Washington. The Project also includes the SR 167 corridor from SW 43<sup>rd</sup> Street (MP24.35) to I-405 (MP 26.26).

The Project limits are within Sections 17, 19, 20, 30, and 31, Township 23N, Range 5E.

The Project is located within Water Resource Inventory Area #9 (WRIA #9) within the Springbrook Creek drainage basin.



### 1.3 VICINITY MAP





## 1.4 PROPOSED IMPROVEMENTS

The Project proposes roadway and shoulder widening, embankment fills, roadway cross-slope corrections, barrier installation, sign bridge installation, ITS and tolling installation, and other construction. These Project elements trigger stormwater modifications and additions. The following hydraulic features are proposed for the Project: pavement drainage systems consisting of catch basins and pipes, conveyance ditches, fish barrier removal through stream restoration and culvert replacement, flow control ponds, and water quality BMPs including compost-amended biofiltration swales (CABS) and media filter drains (MFD).

The proposed stormwater features have been designed using WSDOT guidelines to protect the travelled roadway from runoff and to protect the downstream systems from flow rate and water quality impacts as required by the Contract and environmental permit commitments for the Project. A large, fish-passable structure for the Rolling Hills/Thunder Hills creek crossing will replace Culvert 76 which presents a potential barrier to fish due to flow velocities. The new fish-passable structure will cross SR 167 near SW 19<sup>th</sup> Street. The fish-passable structure design is being performed to comply with Federal Permanent Injunction No. C70-9213 dated March 29, 2013. Originally Rolling Hills Creek was going to be impacted by the Project widening along SR 167, so a commitment was made to relocate the stream and replace the fish passage structure. This widening is not required for the current project configuration, but the commitment will be honored. The stream relocation and fish passage structure will be forward compatible for future widening along SR 167.

The Project widening and noise wall construction along NB I-405 will include a large hillside cut that will remove several homes, S 14<sup>th</sup> Street and portions of intersecting City of Renton streets. S 14<sup>th</sup> Street will be rebuilt approximately 200 feet to the south, outside of WSDOT right-of-way.

## 2 PRE-PROJECT DRAINAGE SYSTEM

The Project site is located in an urbanized part of the City of Renton, along SR 167 and I-405. The majority of work for the Project begins north of SW 43<sup>rd</sup> Street and SR 167 and ends prior to the SR 169 (Maple Valley Highway) exit. I-405 is located at the base of the foothills of the Renton Highlands neighborhoods. The hillsides are to the east of SR 167 and south and then east of I-405 as it turns from east-west to north-south. The hillside is setback from SR 167 by a large wetland complex (Panther Creek Wetlands). SR 167 through the Project is very flat, having been constructed through the valley floor. West of SR167 is East Valley Road and industrial and commercial development. SR 167 is elevated from the surrounding terrain by walls and embankment slopes. Near the interchange the highway begins climbing to meet the elevation of I-405. To the east and northeast of I-405 the topography rises to form the hillsides, with some slopes being fairly steep. To the north and west of the interstate this is relatively flat. The area is the urban



core of the City of Renton and is almost entirely urbanized. Prior to the construction of the freeway the surface runoff traveled west and north towards Lake Washington, perpendicular to the I-405 alignment. It is intersected by several creeks flowing west. Freeway construction and urban development in the 1960s and 1970s cut through the hillsides and maintained the major flow patterns through series of culverts and cross-drains. Minor flow routes interrupted by the original freeway construction were conveyed by roadside ditches and pipe systems. Elevations along the roadway range from a low of 50 feet near the SR 167 interchange to a height of 100 feet near the Thunder Hills culvert crossing (north end of the Project). Elevations are referenced to the North American Vertical Datum of 1988 (NAVD 88). Figure 2 depicts the regional topographical features along the Project. The topography generally slopes from east to west. The highest location on the highway is located near the Thunder Hills Creek culvert crossing along the mainline interstate (I-405 MP 3.05).

The land use of adjacent areas consists of mostly residential (single family and high-density) and commercial/industrial. The highway separates the land uses into two distinct sections: on the south and east sides the land use is primarily residential. On the north and west sides the land use is mostly commercial/industrial. Major arterial crossings of the Project corridor include Talbot Road and Benson Road. SR 167 becomes Rainer Avenue S just north of I-405.

## **2.1 PRE-PROJECT CULVERTS AND CROSS-DRAINS**

There are eight cross-drains and culverts within the Project Limits. They are listed in the table below.



**Table 2.1: Culverts and Cross-drains**

Number	Threshold Discharge Area	Pipe Size and Type	Milepost	Description
C-42	S2.2	48-inch concrete	I-405 2.33	Federal Permanent Injunction C70-9213 listed fish barrier, WDFW culvert ID 995470. Three segment culvert containing Rolling Hills Creek.
C-44	S2.2	132-inch corrugated metal	I-405 2.40	Overflow culvert for Rolling Hills Creek crossing I-405. Built in 1990. Discharge next to C42.
C-48	S2.3	30-inch concrete	I-405 2.65	WDFW culvert ID 992384. Lower Rolling Hills Creek crossing I-405. No fish use. Primarily conveys residential area between S14th and S15th streets.
C-49	S2.3	42-inch corrugated metal	I-405 2.76	Contains Upper Rolling Hills Creek between S 15 <sup>th</sup> Street and Renton Village Place. Serves as city drainage system for Talbot Road.
C-52	S2.4	48-inch steel; concrete	I-405 3.06	Federal Permanent Injunction C70-9213 listed fish barrier, WDFW culvert ID 994406. Thunder Hills Creek Crossing I-405. Original corrugated metal pipe failed and was replaced in 2007 with new concrete and steel culvert. Original downstream concrete pipe under Benson Road.
C-72	S2.1	19'-2" x 11'9" Aluminum Plate Pipe Arch	SR 167 25.66	SR 167 Fish Passable Culvert containing Panther Creek. Constructed in 2012 as part of WSDOT I-405 Thunder Hills Creek Mitigation Retrofit Project.
C-76	S2.2	4-foot wide x 3-foot high concrete box culvert	SR 167 26.07	Federal permanent injunction number C70-9213 listed fish barrier. WDFW Culvert ID 991202. Rolling Hills Creek crossing SR 167. Structure to be replaced by Project.
Unnamed	S2.1	2-36-inch corrugated metal	SR 167 25.94	Cross-culverts through 19 <sup>th</sup> St utility maintenance berm. Maintains hydraulic connectivity for wetlands. To be replaced by Project in new maintenance berm.



## Culverts and Cross-drains





## 2.2 PRE-PROJECT STREAM CROSSINGS

There are five streams that receive stormwater runoff from the Project corridor. From upstream to downstream they are: Thunder Hills Creek, Upper Rolling Hills Creek and Lower Rolling Hills Creek, Rolling Hills Creek and the Panther Creek Wetlands. Upper, Lower and the main stream of Rolling Hills Creek flow directly through and across the Project Limits, Thunder Hills Creek is just north of the work for the Project, and Panther Creek is just to the south. All of these water bodies are tributaries of Springbrook Creek and are located in the Black River/Springbrook Creek Basin.

### Lower Rolling Hills Creek

Lower Rolling Hills Creek begins near a series of wetlands just west of Talbot Road, between I-405 and S 15<sup>th</sup> Street. These wetlands collect local drainage from an area bound by Morris Avenue to the west, S 15<sup>th</sup> Street to the south, S 14<sup>th</sup> Street to the north, and Talbot Road to the east. Drainage from Talbot Road does not flow into this wetland system, and concentrated flows are rare enough that there is no defined channel. Downstream of the wetland that is southeast of the intersection of Morris Avenue and S 14<sup>th</sup> Street, the wetland flows into a 30-inch culvert and then crosses under I-405 (Culvert 48). Culvert 48 discharges to an open channel on the north side of I-405. This open channel continues as Lower Rolling Hills Creek, flowing west parallel the interstate for another 300 feet.

### Upper Rolling Hills Creek

Upper Rolling Hills Creek, in the Project Vicinity, enters a City of Renton Storm System at the southeast corner of the intersection between S 15<sup>th</sup> Street/S Puget Avenue and Talbot Road (SR 515). The stream enters enclosed conveyance through a large open-top circular concrete structure with a debris barrier. The structure is approximately 10 feet deep with a 36-inch outlet pipe that conveys flows north along the east side of Talbot Road. This storm system runs along the east side of Talbot Road to a crossing approximately 270 feet south of I-405. At this location, the pipe size increases to 42 inches. It then runs along the west side of Talbot Road and crosses I-405 just west of the Talbot Bridge overpass. This crossing is identified as Culvert 49. Culvert 49 continues north to Renton Village Place. There is a short segment of 60-inch pipe before it intersects with a larger 72-inch culvert running west in the Triton Towers parking lot, north of Renton Village Place (Culvert 47). Culvert 47 continues west approximately 740 feet where transitions to a 6-foot wide by 4-foot high concrete box culvert that runs southwest for 540 feet where it discharges to a daylighted stream segment. At this location, Upper Rolling Hills Creek merges, and the combined daylighted stream is identified as Rolling Hills Creek.

Most of Upper Rolling Hills Creek flows through a piped system throughout the Project area. One of the open channel areas, upstream of the large concrete drop structure (intersection of S Puget Drive and Talbot Road S), the streambed is overgrown with blackberries, making the channel and pipe inaccessible for view and inspection (01/12/2017). This pipe system is identified as 36" CMP pipe.



## **Rolling Hills Creek**

Rolling Hills Creek flows west along the north side of the interstate for approximately 220 feet past the concrete box outfall, and then into a series of culverts below the loop ramps and off-ramps of the I-405 and SR 167 interchange. In the current configuration Culvert 42 (48-inch concrete) serves as the primary flow path for Rolling Hills Creek and Culvert 44 (132-inch CMP) serves as a high-flow bypass. Culvert 42 runs 400 feet west across the westbound I-405 to northbound Rainier Ave S ramp, then turns south to cross I-405. Culvert 44 runs directly south across I-405. The two culvert outfalls are next to each other, just south of the northbound SR167 to northbound I-405 ramp. Rolling Hills Creek continues south 550 feet as a roadside ditch along the east edge of the ramp to Culvert 76, a 4-foot wide by 3-foot high box culvert. Culvert 76 crosses SR 167 to the southwest and connects to a 60-inch City of Renton storm pipe. This pipe runs south in East Valley Road to SW 19<sup>th</sup> Street where it turns west. This 60-inch system continues west 2,250 feet where it discharges to Springbrook Creek.

Between I-405 (Culverts 42 and 44) and SR 167 (Culvert 76), Rolling Hills Creek enters a wetland complex. The wetland hydrology is dominated by groundwater seeps from the hillside to the east. During dry summer season, the wetland pool is higher than Lower Rolling Hills Creek and flows from the wetland to the creek channel through a shallow channel located near Culvert 76. The wetland pool is also hydraulically connected to the Panther Creek wetland through twin culverts located in a utility berm at the south end of the wetland pool. The berm is located at SW 19<sup>th</sup> Street, where a 16-inch waterline crosses SR 167. The average flow conditions in Lower Rolling Hills Creek are generally independent of the wetland when flows are less than the 2-year peak flow rate. High flows overtop the channel banks and result in flooding of the wetland and a flow split through the twin culverts. The relationship between the stream and wetlands was studied to assure that the project maintains the pre-project flood storage (hydrology) and flow split (hydraulics) between the City storm drainage system in SW 19<sup>th</sup> Street and through the culverts to the Panther Creek wetland.

## **Thunder Hills Creek**

Thunder Hills Creek originates in the Renton Highlands area, south of I-405 and east of Benson Road S. The stream flows from south to north through a deep, forested ravine until it approaches I-405. The stream flows below I-405 in a 48-inch culvert (Culvert 52) and then daylights on the north side of Benson Road in a 4-foot wide by 2-foot, 10-inch concrete-lined channel along the south property line of Sam's Club. The concrete lined channel flows west/southwest towards Talbot Road. The stream flows past a large wetland complex located north of the southbound I-405 to Talbot Road off-ramp. The channel then flows into a 60-inch by 42-inch pipe arch below Talbot Road. On the west side of Talbot Road the pipe arch connects to a catch basin with a 60-inch pipe outlet. The 60-inch pipe runs south 360 feet through the Triton Towers parking lot. It then turns west for 60 feet before merging with the 72-inch concrete pipe containing Upper Rolling Hills Creek.

The 48-inch culvert crossing below I-405 was installed during the original construction of I-405. In October 2008, the culvert collapsed. WSDOT performed an emergency repair of the culvert, replaced the culvert with a concrete and steel 48-inch pipe, and extended the



length several hundred feet upstream of the original culvert entrance to address future I-405 widening. The section below Benson Road was left in place because it was unaffected by the pipe collapse.

Thunder Hills Creek is a flashy, high flow stream that flows in a deep, incised channel for most of its length up to the I-405 culvert. Upstream development has contributed to the nature of the high flows. High flows and large debris movement are associated with this stream.

### **Panther Creek**

The Panther Creek watershed is approximately 2.3 square miles in area. Its headwaters are located near Panther Lake within the City of Kent. Flows are conveyed from Panther Lake under SR 515, through a concrete flume, under Talbot and Carr Roads before being conveyed across an alluvial fan located near the bottom of the Talbot Hill. Conveyance channels across the alluvial fan are unstable and often change over time. Flows are conveyed directly to Panther Creek Wetland or to the eastern edge of SR 167 where a stream channel has been constructed to maintain the hydraulic connection to the wetland. Various culvert crossings under SR 167 have been plugged, so flow entering Panther Creek Wetland is conveyed north to Culvert 72, under SR 167 and into the SW 23<sup>rd</sup> Street Tributary. The SW 23<sup>rd</sup> Street Tributary conveys flows down the P-9 channel and discharges into Springbrook Creek.

Culvert 72 was replaced in 2012 as a fish passage structure connection to the SW 23<sup>rd</sup> Street (also called P-9) channel.

Panther Creek interacts with Rolling Hills Creek through a series of culverts in the two utility access berms that are located between Culvert 72 and Culvert 76.

## **2.3 PRE-PROJECT DITCHES AND OPEN CHANNEL FLOW**

Within the Project Limits there are existing ditches conveying pavement drainage either directly or via discharge from pipe and catch basin networks. These are separate from the man-made segments of the streams described in Section 2.2. The primary ditch conveyance along SR 167 is located at the toe of a retaining wall along the southbound edge. There are also ditches along the edges of ramps and infield areas of the interchange. The ditches on I-405 are primarily located in the northern/eastern Project Limits. They provide conveyance in the infield and along the edges of the Talbot on and off ramps. The Triton Towers parking lot also has an asphalt swale conveying highway run-off to the Upper Rolling Hills Creek culvert. Ditches that are impacted by the Project will be replaced with new ditches or enclosed conveyance systems.



## **2.4 PRE-PROJECT ENCLOSED DRAINAGE SYSTEM**

The majority of the existing conveyance within the Project Limits is provided by inlet and pipe systems. Older I-405 networks and much of SR 167 were inspected and inventories were created by the Renton Stage 1 and Stage 2 Projects. The newer storm networks constructed by those projects were as-built. These sources create nearly complete references for system size, type, location and condition. Portions of the SR 167 conveyance were difficult to inspect during Renton Stages 1 and 2 due to access and maintenance issues. The Existing Conditions Drainage Report for the Project provided an update of this information for the networks hydraulically modified by the Project.

### **SR 167 Corridor**

The SR 167 enclosed conveyance within the limits of work is primarily located along the existing median. It either collects super-elevated pavement or the inside portions of the crowned roadway section. Median drainage is challenging due to very flat longitudinal slopes. Renton Stage 1 modified the median by warping the shoulder and providing slotted drains to aid in the collection of pavement drainage. The inlets in the median typically have outfall pipes that run east to the Panther Creek Wetlands. Drainage to the outside of northbound and southbound SR 167, south of the Panther Creek crossing, primarily flows across media filter drains. Along northbound SR 167, the pavement sheet flows across the media filter drain and directly to the wetlands. The southbound roadway edge is protected by barrier and with inlets installed at intervals. For the most part they have short segments of pipe discharging to the ditches at the toe of the wall. The northbound pavement, north of the crossing, sheet flows untreated to the wetlands.

### **SR 167/I-405 Interchange**

Conveyance networks in the southwest quadrant of the interchange include an outfall pipe from an existing detention pond and cross-drains linking ditches. The networks of pipes and ditches converge in a pipe at the north end of East Valley Road (as it transitions to SW 16<sup>th</sup> Street). This 60-inch conveyance network runs south in East Valley Road toward SW 19<sup>th</sup> Street. This conveyance becomes Rolling Hills Creek at the Culvert 76 connection.

The southeast quadrant of the interchange discharges to Rolling Hills Creek. The infield of the loop ramp drains to an inlet that connects via a pipe to Culvert 42. The northbound SR 167 to northbound I-405 ramp and infield areas drain through a conveyance network to an outfall next to the ends of Culverts 42 and 44.

### **I-405 Rolling Hills Creek Discharge**

Pavement runoff from northbound I-405, between the interchange and Talbot Road, and southbound, between the interchange and approximately 500 feet east of Talbot Road, is collected and conveyed by inlet and pipe systems. These systems discharge to Rolling Hills Creek either through the pipe system along the northbound SR 167 to northbound I-405 ramp or via cross a cross drain to the daylighted section of Rolling Hills Creek along Southbound I-405.



### **I-405 Upper Rolling Hills Creek Discharge**

The southbound I-405 pavement area, approximately 500 feet west of Talbot Road to the east end of the Talbot overpass, is either collected by catch basins with individual outfall pipes or it drains across media filter drain. Both the media filter drain and outfall pipes appear to discharge to the Triton Towers parking lot where drainage consolidates into the asphalt swale described in Section 2.2.4. This swale is collected by a parking lot drain that is connected to Culvert C49 (Upper Rolling Hills Creek).

### **I-405 Thunder Hills Talbot Crossing Discharge**

Northbound pavement from the east end of the Talbot overpass to approximately 400 feet east of the Benson Road Bridge is collected in median catch basins. This system runs west along the median to a structure just west of the bridge and then crosses southbound I-405 to structure in the shoulder and then to a structure in the embankment between southbound I-405 and the southbound I-405 to Talbot Road off-ramp. Southbound I-405 within these limits drains through media filter drain with underdrains that connect to catch basins. Storm pipes from these catch basins connect to the shoulder or embankment structures described above. The outlet from the embankment structure embankment is a 24-inch pipe. This pipe runs north, crosses the off-ramp, bypasses a modified media filter drain and discharges to the surface through an open-top structure with a birdcage. The modified media filter drain is off-line from the mainline system, only treating drainage from the off-ramp. North of the open-top structure is a wetland that drains to the 60-inch by 42-inch pipe arch culvert crossing Talbot Road.

### **I-405 Thunder Hills/Benson Pond Discharge**

Southbound I-405 pavement, 400 feet east of the Benson Road Bridge to the start of the southbound I-405 to Talbot Road off-ramp, drains through media filter drain with an underdrain. Northbound pavement is collected by median catch basins. The underdrains connect to structures in the southbound shoulder. The northbound drainage connects to one of the catch basins in the southbound shoulder. The southbound catch basins discharge to a flow control pond in the infield between southbound I-405 and Benson Road. The outfall from the flow control pond crosses Benson Road and connects to a conveyance system in the southbound I-405 to Talbot Road off-ramp. This conveyance system runs along the left shoulder of the ramp approximately 780 feet west and connects to the 24-inch pipe crossing the ramp (described above). This system is at the end of the major work for the Direct Connect Project.



## 2.5 PRE-PROJECT BRIDGES AND BRIDGE DRAINS

There are no bridges on SR 167 within the work limits for the Project. There are several bridges on I-405 within the work limits. The bridges drain to catch basins located off of each end. The catch basins connect to conveyance networks.

The bridge data is as follows:

**Table 2.5: Bridge Data**

Number	Crossing
405/15	I-405 Mainline over SR 167
405/15S-S	I-405 SB to SB SR 167 ramp over SR 167
405/16	I-405 over SR 515 (Talbot Road)
405/17	Benson Road over I-405

## 2.6 PRE-PROJECT FLOOD PLAINS

Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) numbers 53033C0977, 53033C0978, and 53033C0979 identify floodplain zones near the Project. Floodplain zones (mapped AE), associated with Springbrook Creek, and are shown north and south of SW 19<sup>th</sup> Street and west of East Valley Road. The Panther Creek wetlands, including the area north of the SW 19<sup>th</sup> Street utility maintenance berm are mapped AH. Flooding effects in the wetlands are also from Springbrook Creek, but the mapping shows the flooding comes via SW 27<sup>th</sup> Street. These effects do not appear to be accurate because Panther Creek, via the Panther Creek culvert crossing SR 167, is between SW 27<sup>th</sup> Street and SW 19<sup>th</sup> Street.

The development north of the northeast quadrant of the interchange is mapped as AE or AH. This appears to be related to effects from Rolling Hills Creek.

WSDOT constructed the Springbrook Wetland Mitigation Bank, which includes compensatory mitigation for floodplain fill along I-405 and SR 167. The project as configured will not widen into mapped zones along the north side of I-405. The project has minor fill in the mapped zones along SR 167, including the work associated with the relocated Rolling Hills Creek. The existing Rolling Hills Creek channel will be filled. The floodplain volume was evaluated for grading below elevation 19.58. Floodplain storage was calculated for ranges between 19.58 and 16.00, 16.00 to 15.00, 15.00 to 14.00 and 14.00 to 5.00 feet. This analysis was provided in the As-Built Hydraulic Report.



## 2.7 PRE-PROJECT SUBSURFACE DRAINAGE

Subsurface drainage along SR 167 includes pavement drainage along the median barrier and underdrains for the media filter drain along the southbound side. The retaining wall along southbound SR 167 also has a wall drain. These drains connect via drain pipes to catch basins or daylight to ditches. There is significant subsurface drainage north of Talbot Road. This is primarily due to the highway being built into the existing hillside as part of the original construction. WSDOT has installed numerous underdrains to collect the subsurface drainage and convey the water to enclosed pipe systems. There are also extensive underdrain systems built as part of retaining walls along the Talbot Road to northbound I-405 on-ramp. The media filter drains along southbound SR 167 also have underdrains connected to catch basins.

## 2.8 PRE-PROJECT STORMWATER OUTFALLS

Based on review of as-built plans, old hydraulic reports, and field conditions the following locations are outfalls for concentrated stormwater flows from the Project Limits. Their locations are listed below.

**Table 2.8: Outfalls within the Project**

SR/MP/Offset <sup>1</sup>	Condition	Name
167-25.66-L-120	Open Ditch Channel	TDA S2.1
167-25.94-L-160	Closed Conveyance	TDA S2.2
167-26.07-L-105	Closed Conveyance	TDA S2.2
465-2.63-L-106	Open Ditch Channel	TDA S2.3
405-3.05-L-280	Closed Conveyance	TDA S2.4

1. Offset from MP alignment (000ex050\_al\_mp-005.dgn)

## 3 MAINTENACE OF DRAINAGE FEATURES

### 3.1 PROPOSED DRAINAGE SYSTEM

Upon completion of a project specific Environmental Documentation Spreadsheet, the I-405 / SR 167 Project is required to provide flow control and enhanced water quality treatment consistent with the minimum requirements provide in Chapter 3 of the WSDOT 2014 Highway Runoff Manual (HRM).



Flow control best management practices (BMPs) are required for non-exempt areas to reduce the impacts of stormwater runoff from impervious surfaces and land cover conversions. As flow control requirements differ for the TDAs, each is discussed separately below.

### **TDAs S2.2 and S2.3**

These TDAs require flow control for new pavement. Two detention ponds will be provided, one in TDA 2.2 and one in TDA S2.3.

### **TDA S2.1 (Tributary to the Panther Creek Wetland)**

This portion of the TDA is flow control exempt.

### **TDAs S1 and S3**

The soil stockpile areas (TDA S1 and S3) and the temporary construction trailer and parking area (TDA S3) will be restored to existing or better condition. The existing Pond S3.1 was not impacted by the installation of the temporary trailers and parking area. These TDAs are exempt from additional flow control.

The following sections describe the Project's proposed drainage improvements in further detail. See Appendix B, As-Built Drainage Plans, for locations of new conveyance systems, detention facilities, and runoff treatment facilities.

## **3.1.1 COLLECTION AND CONVEYANCE SYSTEM**

The collection and conveyance system for each TDA is described below.

### **TDA S1**

The work in this TDA is limited. The Holmes Electric Pond (Renton Stage 1 Pond S1.1) is located within TDA S1. A compost-amended biofiltration swale will be provided downstream of the pond to add treatment within the Springbrook Creek Basin. A permanent soil embankment will be placed within the northwest quadrant of the I-405/SR 167 Interchange. This area will be restored to existing or better condition.

Existing storm drainage collects and conveys runoff from I-405 into the existing detention pond constructed at the Holmes Electric site during the Renton Stage 1 project. The conveyance from the pond discharges north and then west along I-405 to Springbrook Creek. The conveyance from the pond will be re-configured to discharge into a newly constructed CABS for treatment. The discharge from this CABS will connect into the existing outfall system from the previously constructed Holmes Electric detention pond. The soil embankment in the northwest quadrant of the interchange will not require modifications to storm drainage or outfalls in this TDA.

### **TDA S2.1**

Stormwater collection and conveyance will be provided to accommodate drainage along the southbound side of the median barrier. There are also storm runs along the along



northbound SR 167 to convey and outlet existing storm drain systems that are cutoff by the new widening of northbound SR 167. New outfalls with protection will be constructed as close to the toe of the roadway embankment slope as possible. Consideration has been taken to avoid impacting wetlands and their buffers whenever possible.

### **TDA S2.2**

WSDOT future compatibility requirements include discharging the outfall from the S2.2 detention pond to the City of Renton storm drainage system in East Valley Road. This is accomplished by conveying the outlet from the SE Quadrant of the interchange through a new conveyance system crossing the NB SR 167 to NB I-405 ramp. This pipe connects to another pipe installed in the location of the existing Rolling Hills Creek. The pipe connects to the existing Culvert 76 repurposed as a stormwater conveyance. From here the water will cross SR 167 and make the connection with the City of Renton storm system in East Valley Road to the west. No new SR 167 crossing system is needed. This maintains discharge to the City drainage system and facilitates future flow control concepts designed to protect the new Rolling Hills Creek channel. Rolling Hills Creek is routed south to a new fish passage crossing SR 167 and connecting at the intersection between East Valley Road and SW 19<sup>th</sup> Street.

### **TDA S2.3**

Stormwater collection and conveyance will be provided to accommodate drainage along southbound I-405 between Morris Avenue S and the vicinity of the Benson Road Bridge. Existing storm drainage will be utilized to the maximum extent feasible to provide compliance with the pavement drainage requirements. The storm drainage system will collect and convey runoff from I-405 into the new TDA S2.3 pond, located near the intersection of Talbot Road and S Renton Village Place. The outfall from this pond will connect into the existing City of Renton storm drainage system that conveys Upper Rolling Hills Creek.

### **TDA S2.4**

Stormwater collection and conveyance will be provided to accommodate drainage along the Talbot on-ramp to northbound I-405. Existing storm drainage will be utilized to the maximum extent feasible to provide compliance with the pavement drainage requirements.

### **TDA S3**

Permanent soil embankments will be placed between SR 167 and the SW 43<sup>rd</sup> Street on- and off-ramps. These areas will be restored to existing or better condition. A permeable rock access will be provided to a new camera. Construction trailers and gravel parking were installed south of SW 27<sup>th</sup> St. in a parcel containing a stormwater pond constructed by Renton Stage 1. The pond was not impacted and the area will be restored to pre-project condition.

A culvert across the camera access will be installed to maintain flow between the ditch segments upstream and downstream.



### **3.1.2 TREATMENT SYSTEM**

The runoff treatment systems for each TDA is described below.

#### **TDA S1**

A new compost-amended biofiltration swale (CABS) is proposed to provide enhanced stormwater runoff treatment. This treatment is part of the 10.21-acre retrofit goal within the Springbrook Creek Basin. Table 3.1.2.2 summarizes the design information for the proposed CABS. The 50-year backwater from Springbrook Creek has been analyzed to show that it will not impact the downstream end of the CABS.

#### **TDA S2.1**

New media filter drain (MFD) is proposed to provide enhanced stormwater runoff treatment along with the existing (MFD). The Project will remove some existing MFD but replace its function with new MFD. Table 3.1.2.1 summarizes the proposed MFD facilities.

#### **TDA S2.2**

New media filter drain (MFD) and compost-amended biofiltration swales (CABS) are proposed to provide enhanced stormwater runoff treatment along with the existing (MFD). The Project will remove some existing MFD but replace its function with new MFD or CABS. Table 3.1.2.1 summarizes the design information for each proposed MFD and Table 3.1.2.2 summarizes the proposed CABS facilities.

#### **TDA S2.3**

New compost-amended biofiltration swales (CABS) are proposed to provide enhanced stormwater runoff treatment along with the existing (MFD). The Project will remove some existing MFD but replace its function with new CABS. Table 3.1.2.2 summarizes the design information for the proposed CABS.

#### **TDA S2.4**

New media filter drain (MFD) is proposed to provide enhanced stormwater runoff treatment along with the existing (MFD). The Project will remove some existing MFD but replace its function with new MFD. Table 3.1.2.1 summarizes the design information for the proposed MFD.

#### **TDA S3**

The camera access is less than 5,000 square feet and constructed from permeable rock. This work is exempt from runoff treatment.



**Table 3.1.2.1: Proposed MFD for Project TDAs**

<b>MFD ID</b>	<b>START STATION/ NORTHING</b>	<b>START OFFSET/ EASTING</b>	<b>LENGTH (Ft)</b>	<b>SIDE-SLOPE (Ft/Ft)</b>	<b>Treated PGIS<sup>1</sup> (AC)</b>
DR07-4	NB167 323+25.26	36.42' LT	1,120	4:1	1.64
DR07-7	NB167 318+04.40	35.00' RT	169	4:1	0.23
DR13-31	SB405 1219+88.10	48.11' LT	975	4:1	1.06
DR14-11	SB405 1227+23.50	64.50' LT	290	6:1	0.76

1. BMPs provide treatment to account for existing water quality BMPs impacted by the project.

**Table 3.1.2.2: Proposed CABS for Project TDAs**

<b>CABS ID</b>	<b>START STATION/ NORTHING</b>	<b>START OFFSET/ EASTING</b>	<b>LENGTH (Ft)</b>	<b>BOTTOM WIDTH (Ft/Ft)</b>	<b>SIDE-SLOPE (Ft/Ft)</b>	<b>Treated PGIS<sup>1</sup> (AC)</b>
DR10-07	NB167 349+33.77	75.49' RT	123	15.00	3:1	8.19
DR12-28	SB405-SB 25+35.21	143.56' LT	120	5.00	3:1	4.01
DR10A-5	173358.28	1295976.84	100	6.00	3:1	4.99

1. BMPs provide treatment to account for existing water quality BMPs impacted by the project.

### 3.1.3 DETENTION SYSTEM

The detention systems for each TDA is described below.

#### TDA S2.2

The S2.2 detention pond is located within the loop of the northbound I-405 to northbound SR 167 ramp. The pond collects stormwater runoff from northbound I-405 between SR167 and Talbot Road, bordered on the south by S 14th Street. It provides flow control for 3.99 acres of new WSDOT impervious roadway, 0.376 acres of pond surface, and 0.72 acres of impervious to compensate for filling of the southwest quadrant pond that was constructed during the Renton Stage 1 project. The total contributing area is 11.43 acres where 1.421 acres of grass area and 2.464 acres of impervious area pass through the pond in compliance with the flow-through unmitigated area allowed by the HRM. The pond will discharge to a compost amended biofiltration swale (CABS), and then connect through Culvert 76 (via open conveyance) to the East Valley Road storm drainage systems. The area mitigated by the removal of the SW Pond has been modeled as bypass.



### **TDA S2.3**

The S2.3 detention pond is located near the intersection of Talbot Road and S Renton Village Place. The pond collects stormwater runoff from I-405 between Morris Avenue S and the vicinity of Benson Road Bridge. It mitigates 3.424 acres of I-405 pavement plus 0.387 acres of pond surface. The total contributing area is 4.514 acres, so 0.134 acres of grass area and 0.585 acres of impervious area pass through the pond unmitigated. The pond will discharge to a compost amended biofiltration swale (CABS) and then into Upper Rolling Hills Creek. A downstream flow comparison was performed, and included in the As-Built Hydraulic Report, that demonstrates a reduction in flow to the City of Renton storm system – mitigating any downstream impacts caused by the widening in this TDA.

### **TDAs S1, S2.1, S2.4, S3**

TDAs S1, S2.1, S2.4, and S3 are exempt from flow control. No new detention facilities are created by the Project within these TDAs. See the Project's As-Built Hydraulic Report for more information.

## **3.2 MAINTENANCE ACTIVITIES AND FREQUENCIES**

The following maintenance activities and frequencies are based on and supplement the material in WSDOT's Maintenance Manual, Highway Runoff Manual (HRM), and Maintenance Accountability Process (MAP) Manual. The activities described in this section are not intended to replace any of the referenced manual recommendations. The minimum drainage standards cited below are based on thresholds for acceptable maintenance as listed in the MAP Manual. Key excerpts from these manuals are provided in Appendices C, D, and E.

### **3.2.1 MAINTENANCE OF COLLECTION AND CONVEYANCE SYSTEM**

Catch basins, grate inlets, storm pipe, and open ditches should be maintained as described in the most current versions of the Maintenance Manual, the HRM, and the MAP Manual. The following summarizes those requirements.

Catch basins, grate inlets, and manholes should be inspected once yearly and after significant rain events. Frequency may be increased or decreased as local knowledge of the area dictates. At a minimum, drainage structures should be cleaned when the inlet is 50% blocked with debris, or if sediment buildup reaches the flow line of the outlet pipe. Detailed standards for catch basin and manhole maintenance can be found in HRM Section 5-5, Table 5-16 and Table 5-14, respectively (see Appendix D). Additional maintenance information for storm sewers can be found in WSDOT Maintenance Manual Chapter 4 under Storm Sewers and Catch Basins (see Appendix C).

Culverts and storm pipes should be inspected twice yearly, preferably once prior to fall/winter storms and once following the rainy season. Additional inspection after



significant rain events is suggested. Frequency may be increased or decreased as local knowledge of the area dictates. At a minimum, culverts should be cleaned or replaced when 50% of the culvert capacity is lost to blockages or failures. Maintenance crews should perform Level One Inspection. If, at the conclusion of the Level One Inspection, potential problems are revealed, a Level Two Inspection should be conducted by a hydraulic engineer. Scour protection at culvert ends should be repaired as necessary, and in cases where scour protection does not exist yet scouring has occurred, the scoured areas should be protected with rip-rap or some other protection as necessary. Detailed standards for culvert maintenance can be found in WSDOT Maintenance Manual Chapter 4 under Culverts (see Appendix C).

Open ditches should be inspected twice yearly, preferably once prior to fall/winter storms and once following the rainy season. Additional inspection after significant rain events is suggested. Frequency may be increased or decreased as local knowledge of the area dictates. Ditches should be kept free of garbage, and at a minimum should be cleaned when 50% of the ditch capacity is lost to blockages. Detailed standards for ditch maintenance can be found in WSDOT Maintenance Manual Chapter 4 under Ditches and Gutter (see Appendix C).

### **3.2.2 MAINTENANCE OF TREATMENT/DETENTION SYSTEMS**

Detention ponds included as part of this Project should be inspected annually, with increased inspections as necessary if the site experiences above normal debris loading. Detailed standards for maintenance can be found in HRM Section 5-5, Table 5-12 (see Appendix D).

The new facilities will have flow control structures located at the downstream end of the facilities. These flow control structures should be inspected annually and after significant rain events to ensure that they are performing properly. Detailed standards for flow control maintenance can be found in HRM Section 5-5, Table 5-15 (see Appendix D). Detailed standards for debris barrier maintenance can be found in HRM Section 5-5, Table 5-17 (see Appendix D).

Other treatment BMPs constructed as part of this Project, including CABS and MFD, should be inspected annually. As annual inspections provide experience, inspections may be increased as necessary. Detailed standards for treatment BMP maintenance, including CABS and MFD, can be found in HRM Section 5-5, Table 5-20, Table 5-19, and Table 5-21, respectively (see Appendix D).

### **3.3 INSPECTION AND MAINTENANCE SUMMARY**

Once the contract is complete the Washington State Department of Transportation Maintenance Area 1 will be responsible for the maintenance and operation of the installed



stormwater facilities. Maintenance procedures outlined in the WSDOT Highway Runoff Manual and the WSDOT Maintenance Manual will be followed. An as-built maintenance manual will be provided at the completion of construction.

Drainage facilities along 14<sup>th</sup> St in the Talbot Hill neighborhood will be maintained by the City of Renton. The following facilities installed by the project are expected to require inspection and maintenance.

**Table 3.3: Summary of Drainage Quantities**

Maintenance Item	Quantity
Mowing of grass lined ditches (swales)	8,823 lf
Number of catch basins	159
Length of enclosed drainage pipe	11,322 lf
Length of other underdrain systems	10,507 lf
Length of CABS	443 lf
Length of MFD	2,264 lf
Number of Detention Ponds	2
Length of traditional culverts	0
Length of fish-passable culverts	195 lf

It is estimated that **XXX** work hours per year will be needed to maintain drainage facilities for the Project.

Additional standards for maintaining stormwater BMPs are found in the Regional Road Maintenance Endangered Species Act Program Guidelines and Best Management Practices Field Guide for ESA §4 (d) Habitat Protection, March 2004, and Instructional Letter (IL) 4057.01 Environmental Compliance Assurance Procedure For Maintenance Work Activities.



### **3.4 NEW STORMWATER OUTFALLS**

There are two new outfalls created by the project. One is the new Rolling Hills Creek fish passage structure (Culvert 76). The west end of the fish passage transitions to a new stormwater outfall connecting to an existing manhole at the intersection of East Valley Road and SW 19<sup>th</sup> Street. The second outfall is a connection from the CABS downstream of Pond S2.3. This CABS discharges to an existing storm system in Renton Village Place which connects to Culvert 49 and then to a City of Renton storm system discharging to the west. Culvert 49 and the downstream storm system convey Rolling Hills Creek. The existing Culvert 76 is not a new outfall, but its function is altered by the project. It is repurposed as a stormwater conveyance with the relocation of Rolling Hills Creek.

### **3.5 WILDLIFE HAZARD MANAGEMENT**

The City of Renton Municipal airport and the Federal Aviation Authority (FAA) require that the design of new stormwater facilities incorporate consideration of air traffic safety concerns where new facilities will be constructed within 10,000 feet of the aircraft operating area. The Project area (including several stormwater facilities) falls within the separation distance of 10,000 feet. The FAA and WSDOT partnered to create the Aviation Stormwater Design Manual (FAA and WSDOT, 2008), which provides stormwater facility design guidance for maintain appropriate stormwater management while minimizing hazardous attraction to wildlife.

### **3.6 STORMWATER BMP INFORMATION PLATES**

Stormwater BMP information plates have been installed for all stormwater flow control and water quality BMPs in accordance with HRM Section 5-5.3 and standard plans M-24.65-00 and M-24.66-00. The information plates identify the type of stormwater BMP and the unique identifier number stored in the WSDOT Highway Activity Tracking System (HATS). The locations of the information plates are shown on the drainage plans and can be found in Appendix C. For ponds, the information plates are located adjacent to the access road near the access to the bottom of the pond. For CABS, the information plates are located at the upstream and downstream ends of the CABS. For MFD, the information plates are located at the beginning and ending of the MFD and at 500-ft maximum spacing along the length of the MFD opposite the roadway.

### **3.7 TALBOT ROAD OVERPASS SPECIAL PIPE MATERIALS**

The project includes an approved Alternative Technical Concept for the use of Fiberglass Reinforced Plastic Pipe (FRPP) for the drainpipes crossing the Talbot Road overpass (bridge number 405/16). Background information regarding the material including can be found in Appendix H.



## 4 REFERENCES

Washington State Department of Transportation (WSDOT)

- 2008 – Aviation Stormwater Design Manual (WSDOT & FAA)
- 2012 – Maintenance Manual
- 2013 – Maintenance Accountability Process Manual
- 2014 – Highway Runoff Manual

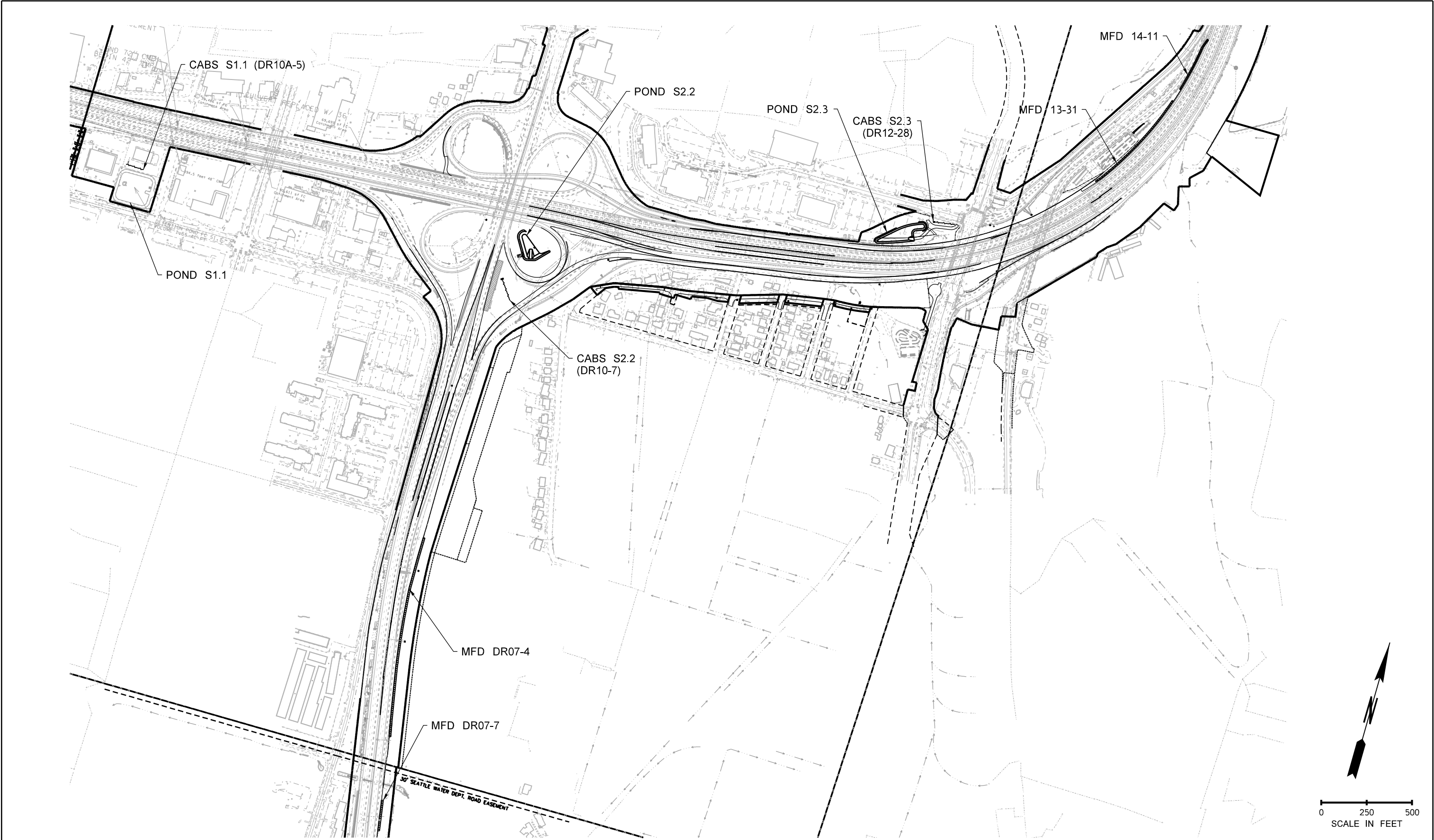
PACE/Jacobs/Atkinson


- 2020 – As-Built Hydraulic Report, I-405 / SR 167 Direct Connector Project



## APPENDIX A: AS BUILT INSPECTION AND MAINTENANCE KEY






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- ◆ - TDA BOUNDARY

NEW PGIS AREA

NEW NPGIS AREA

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REGIONAL ADM.	L. ENG								REVISION		DATE		BY		
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1. THIS EXISTING MFD AND CORRESPONDING WATER QUALITY (WQ) AREA HAVE NOT BEEN INCLUDED IN THE PRE VS POST - PROJECT WQ AREA ACCOUNTING PROCESS. THE EXISTING MFD AND CONTRIBUTING AREA ARE NOT ALTERED AS A RESULT OF THIS PROJECT.

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- ◆ - TDA BOUNDARY

NEW PGIS AREA

NEW NPGIS AREA

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P.E. STAMP BOX		DATE	
P.E. STAMP BOX		DATE	



SEC.30 T.23N. R.5E. W.M.

EXISTING MFD TO REMAIN (TYP)

SB SR167

E167 LINE

NB167 LINE

NB SR167

11085

285

11090

290

E167 LINE

TDA S2.1

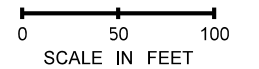
EXISTING WQ AREA S2.1:1  
SEE FIGURE 03

EXISTING WQ AREA S2.1:2A  
SEE FIGURE 05

EXISTING WQ AREA S2.1:2B  
SEE FIGURE 05

MATCH LINE NB167 283+00.00 SEE FIGURE 03


MATCH LINE NB167 294+50.00 SEE FIGURE 05



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NEW PGIS AREA

NEW NPGIS AREA

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PROJ. ENGR. C. CHEN								SHEETS						
REGIONAL ADM. L. ENG		REVISION	DATE	BY			<b>POST PROJECT WQ AREA</b>							



**SEC.30 T.23N. R.5E. W.M.**

EXISTING COMBINED DETENTION POND WETLAND TO REMAIN

EXISTING WQ AREA S2.1.2A TO EXISTING COMBINED DETENTION POND WETLAND 3.00 AC PGIS

**TDA S2.1**

SB SR167

11095

295

11100

300

205

365

EXISTING WQ AREA S2.1.2B TO EXISTING COMBINED DETENTION POND WETLAND 1.27 AC PGIS

EXISTING WQ AREA S2.1.3 TO EXISTING MFD 1.35 AC PGIS

EXISTING MFD (NOT SHOWN IN BASE MAP) TO REMAIN

MATCH LINE NB167 294+50.00 SEE FIGURE 04

11095

295

11100

300

205

365

- EXISTING WQ AREA S2.1.2A  
TO EXISTING COMBINED DETENTION-POND WETLAND  
3.00 AC PGIS

EXISTING WQ AREA S2.12B  
TO EXISTING COMBINED DETENTION POND WETLAND  
1.27 AC PGIS

— EXISTING WQ AREA S2.13  
TO EXISTING MFD  
1.35 AC PGIS

— EXISTING MFD (NOT SHOWN  
IN BASE MAP) TO REMAIN




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## LEGEND

- ◆ - TDA BOUNDARY

NEW PGIS AREA

NEW NPGIS AREA

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												POST PROJECT WQ AREA		SHEETS	



SEC.30 T.23N. R.5E. W.M.

E VALLEY RD

EXISTING WQ AREA S2.1.2A  
SEE FIGURE 05

EXISTING WQ AREA S2.1.4A  
TO EXISTING MFD  
0.23 AC PGIS

EXISTING WQ AREA S2.1.4B  
TO EXISTING MFD  
0.76 AC PGIS

EXISTING MFD  
TO REMAIN

SB SR167

210

215

NB SR167

310

315

NB167 LINE

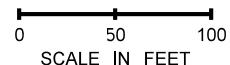
TDA S2.1

EXISTING WQ AREA S2.1.3  
SEE FIGURE 05

EXISTING MFD (NOT SHOWN  
IN BASE MAP) TO REMAIN


MATCH LINE NB167 305+50.00 SEE FIGURE 05

INDICATOR 217+00.00 SEE FIGURE 07



## LEGEND

- ◆ — ◆ - TDA BOUNDARY
- NEW PGIS AREA
- NEW NPGIS AREA

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PROJ. ENGR. C. CHEN															
REGIONAL ADM. L. ENG		REVISION	DATE	BY	C8811										
										DATE		DATE		POST PROJECT WQ AREA	
										P.E. STAMP BOX		P.E. STAMP BOX			



**SEC.30 T.23N. R.5E. W.M. / SEC.19 T.23N. R.5E. W.M.**

SW 23RD ST

E VALLEY RD

WQ AREA S2.1.8 TO MFD 1.64 AC PGIS

EXISTING MFD TO REMAIN

EXISTING WQ AREA S2.1.4 SEE FIGURE 06

SB SR167

NB SR167

NB167 LINE

220

225

320

325

NB SR167 TO NB 1405 FLYOVER RAMP

TDA S2.1

PROPOSED MFD (TYP)

CULVERT 72

WQ AREA S2.1.7 TO MFD 0.23 AC PGIS

DR07 7

DR07 4

MATCH LINE NB167 317+00.00 SEE FIGURE 06

MATCH LINE NB167 328+00.00 SEE FIGURE 08

0 50 100 SCALE IN FEET

**LEGEND**

- ◆ - TDA BOUNDARY
- NEW PGIS AREA
- NEW NPGIS AREA

[illegible]



SEC.19 T.23N. R.5E. W.M.

SW 19TH ST

E VALLEY RD

1 VALLEY LINE

TDA S2.1

SB SR167

SB I405 TO SB SR167 FLYOVER RAMP

DC-A LINE

DC-B LINE

DC-F LINE

NB SR167 TO NB I405 FLYOVER RAMP

NB SR167

TDA S2 SUB BASIN S2.2

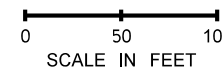
PROPOSED FISH PASSAGE CULVERT

PROPOSED MFD

WQ AREA S2.1.8 SEE FIGURE 07

MATCH LINE NB167 328+00.00 SEE FIGURE 07


MATCH LINE NB167 338+50.00 SEE FIGURE 09



- ◆ - TDA BOUNDARY

NEW PGIS AREA

NEW NPGIS AREA

FILE NAME c:\pwworking\inai\ x_jzgwel\id0334111\WQ Area-08.dgn										<div><p>Washington State Department of Transportation</p></div>		<div>I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR</div>		PLAN REF NO
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DATE 1/8/2020				JOB NUMBER										
PLOTTED BY JeffZ				CONTRACT NO.		LOCATION NO.	SHEET							
DESIGNED BY							OF							
ENTERED BY								SHEETS						
CHECKED BY														
PROJ. ENGR. C. CHEN														
REGIONAL ADM. L. ENG		REVISION	DATE	BY	C8811									

DATE

P.E. STAMP BOX

DATE

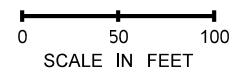
P.E. STAMP BOX

POST PROJECT WQ AREA



[illegible]


MATCH LINE NB167 348+00.00 SEE FIGURE 10



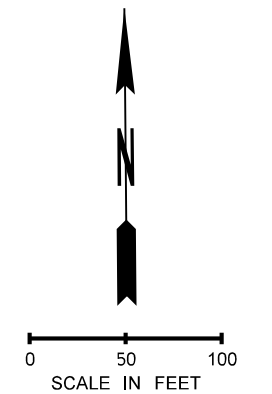
- ◆ — ◆ - TDA BOUNDARY

NEW PGIS AREA

NEW NPGIS AREA

FILE NAME c:\pwworking\inal_x_jzigweid\0334111\WQ Area-09.dgn										 <b>Washington State Department of Transportation</b>		<b>I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR</b>		PLAN REF NO	
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DATE	1/8/2020				10	WASH									
PLOTTED BY	JeffZ				JOB NUMBER										
DESIGNED BY							LOCATION NO.		SHEET						
ENTERED BY															
CHECKED BY					CONTRACT NO.										
PROJ. ENGR.	C. CHEN				C8811		DATE		DATE		OF				
REGIONAL ADM.	L. ENG										REVISION		DATE		BY



[illegible]

- ◆ - TDA BOUNDARY

NEW PGIS AREA

NEW NPGIS AREA

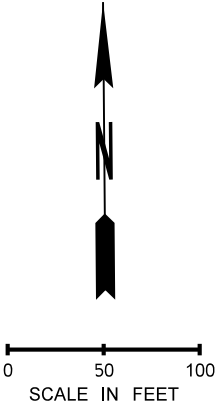
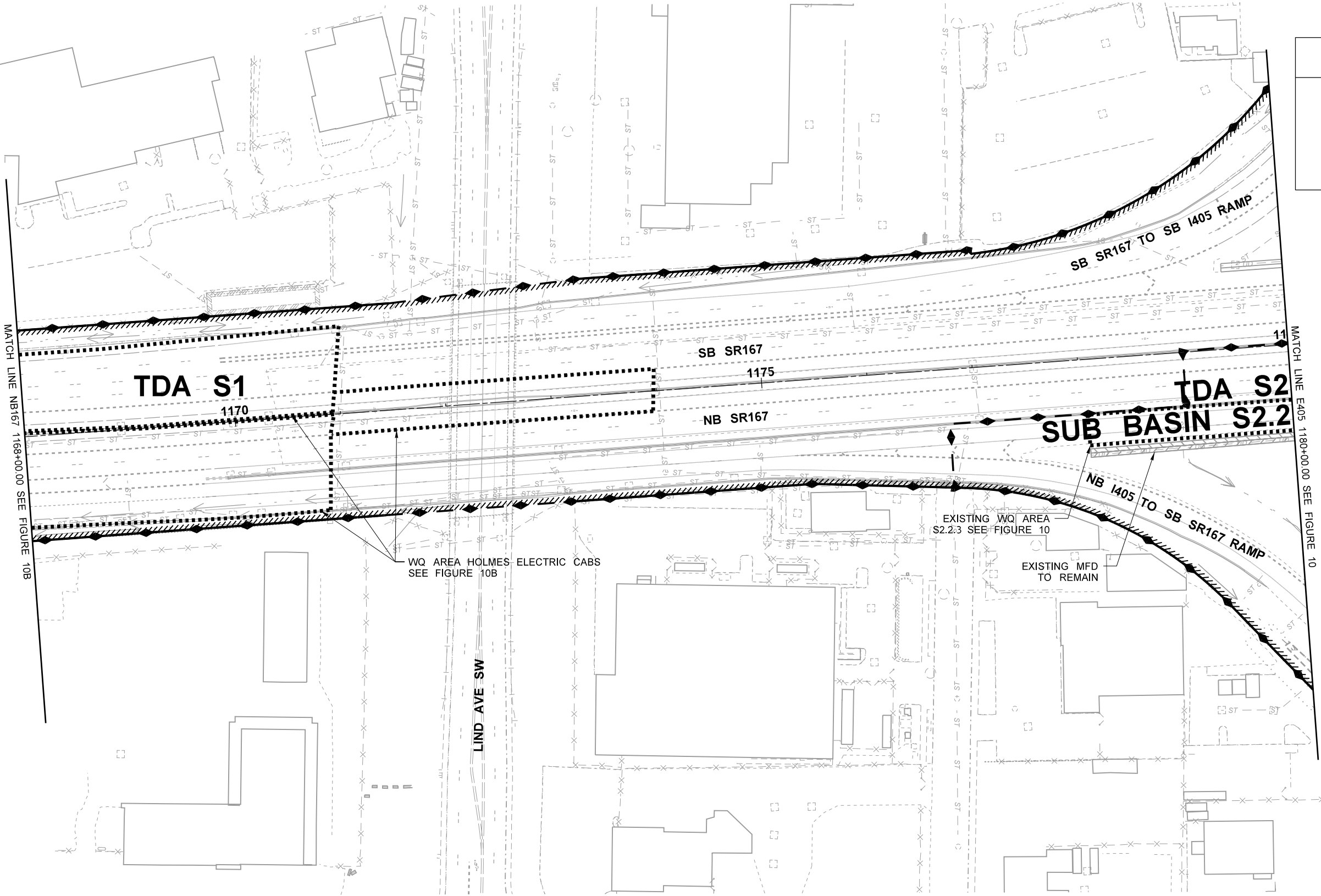
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DATE 1/16/2020															
PLOTTED BY JeffZ						JOB NUMBER		SHEET							
DESIGNED BY						CONTRACT NO.		LOCATION NO.				OF			
ENTERED BY															
CHECKED BY															
PROJ. ENGR. C. CHEN						C8811		DATE		POST PROJECT WQ AREA					
REGIONAL ADM. L. ENG		REVISION		DATE						BY		SHEETS			



SEC.19 T.23N. R.5E. W.M.

LEGEND

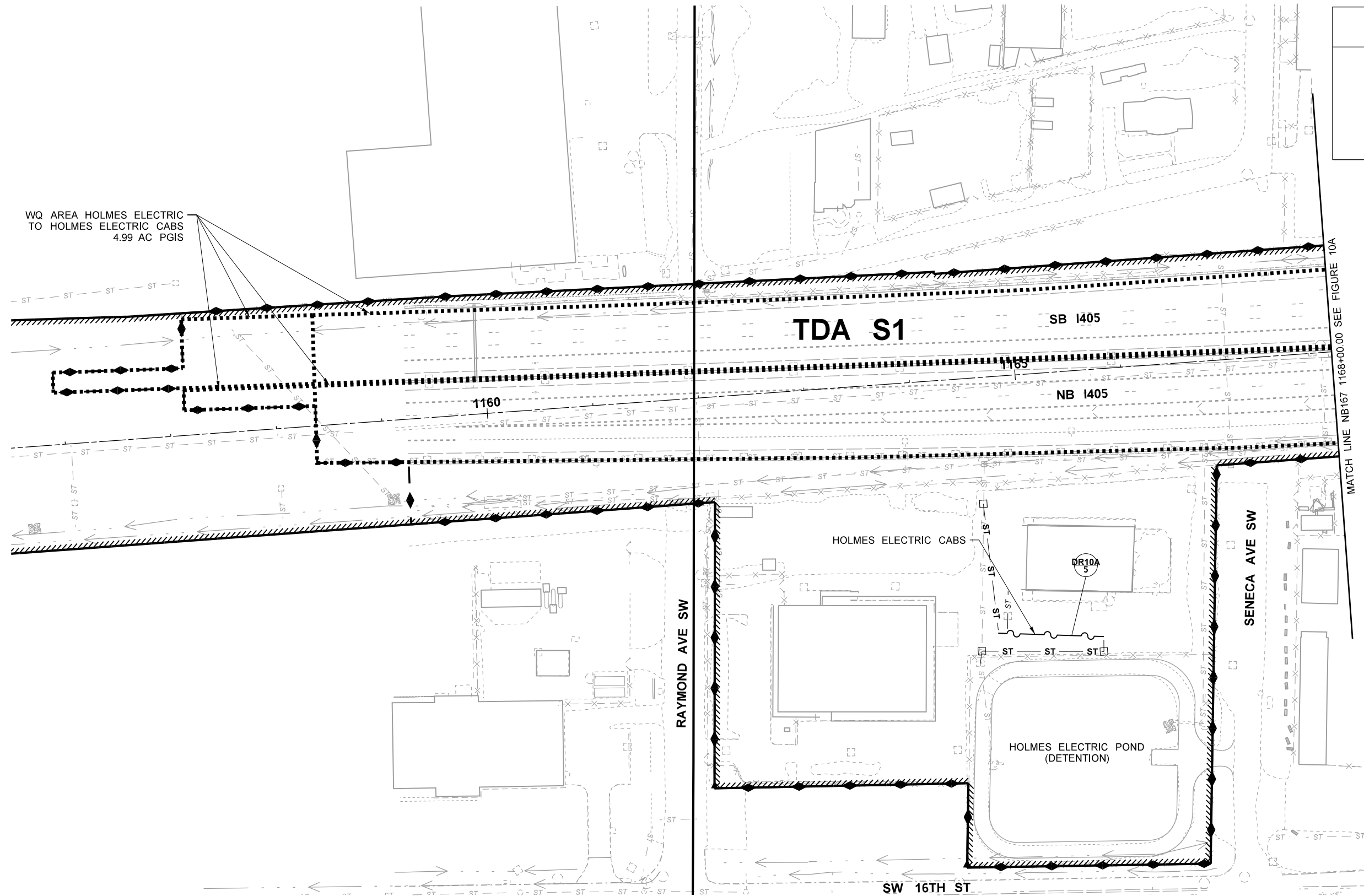
- TDA BOUNDARY
- NEW PGIS AREA
- NEW NPGIS AREA



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## SEC.19 T.23N R.4E. W.M. / SEC.19 T.23N. R.5E. W.M.



## LEGEND

- ◆ — ◆ - TDA BOUNDARY

 NEW PGIS AREA

 NEW NPGIS AREA

MATCH LINE NB167 1168+00.00 SEE FIGURE 10A

# TDA S1

**SB 1405**

**NB 1405**

HOLMES ELECTRIC CABS -


DR10A  
5

HOLMES ELECTRIC POND  
(DETENTION)

SW 16TH ST

SENECA AVE SW

A horizontal scale bar with three tick marks. The first tick mark is at the left end and is labeled '0'. The second tick mark is in the middle and is labeled '50'. The third tick mark is at the right end and is labeled '100'. Below the scale bar, the text 'SCALE IN FEET' is written in all capital letters.

FILE NAME c:\pwworking\inail_x_jzjgweid\0334111WQ Area-10B.dgn										 <b>Washington State Department of Transportation</b>		<b>I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR</b>			
TIME	10:09:05 AM				REGION NO.	STATE	<b>FED.AID PROJ.NO.</b>		PLAN REF NO						
DATE	1/8/2020				10	WASH			10B						
PLOTTED BY	JeffZ				JOB NUMBER										
DESIGNED BY					CONTRACT NO.		LOCATION NO.		SHEET						
ENTERED BY					C8811				OF						
CHECKED BY									SHEETS						
PROJ. ENGR.	C. CHEN								POST PROJECT WQ AREA						
REGIONAL ADM.	L. ENG	REVISION	DATE	BY											



SEC.19 T.23N. R.5E. W.M.

WQ AREA S2.2.5G  
SEE FIGURE 10

WQ AREA S2.2.5C  
SEE FIGURE 10

WQ AREA S2.2.5E  
TO CABS S2.2  
5.17 AC PGIS

SB I405 TO SB SR167 RAMP

SB I405

SB405 LINE

1195

SB405-NB LINE

SB405-SB LINE

SB I405 TO NB SR167 RAMP

15

1200

TDA S1

TDA S2

SUB BASIN S2.3

253

153

1200

DC-F LINE

DC-D LINE

NB SR167 TO NB I405 RAMP

20

30

NB405 LINE

N167-N LINE

25

1195

1200

1201

1202

1203

1204

1205

1206

1207

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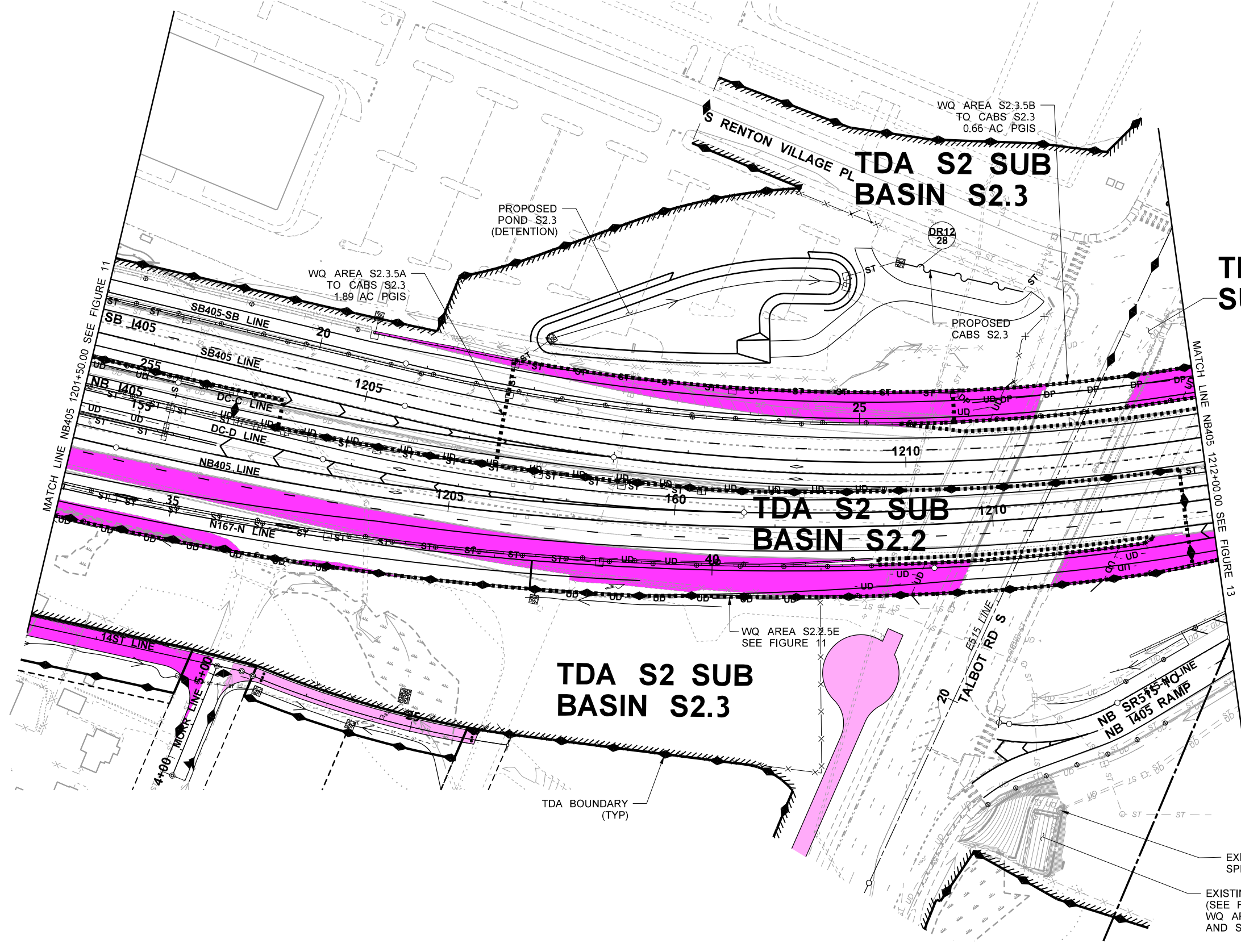
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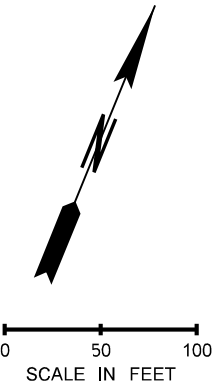
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SEC.19 T.23N. R.5E. W.M. / SEC. 20 T.23N. R.5E. W.M.



TDA S2  
SUB BASIN S2.4

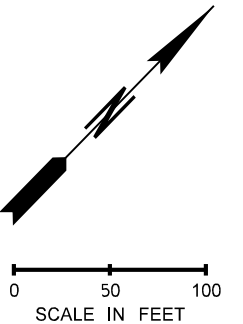
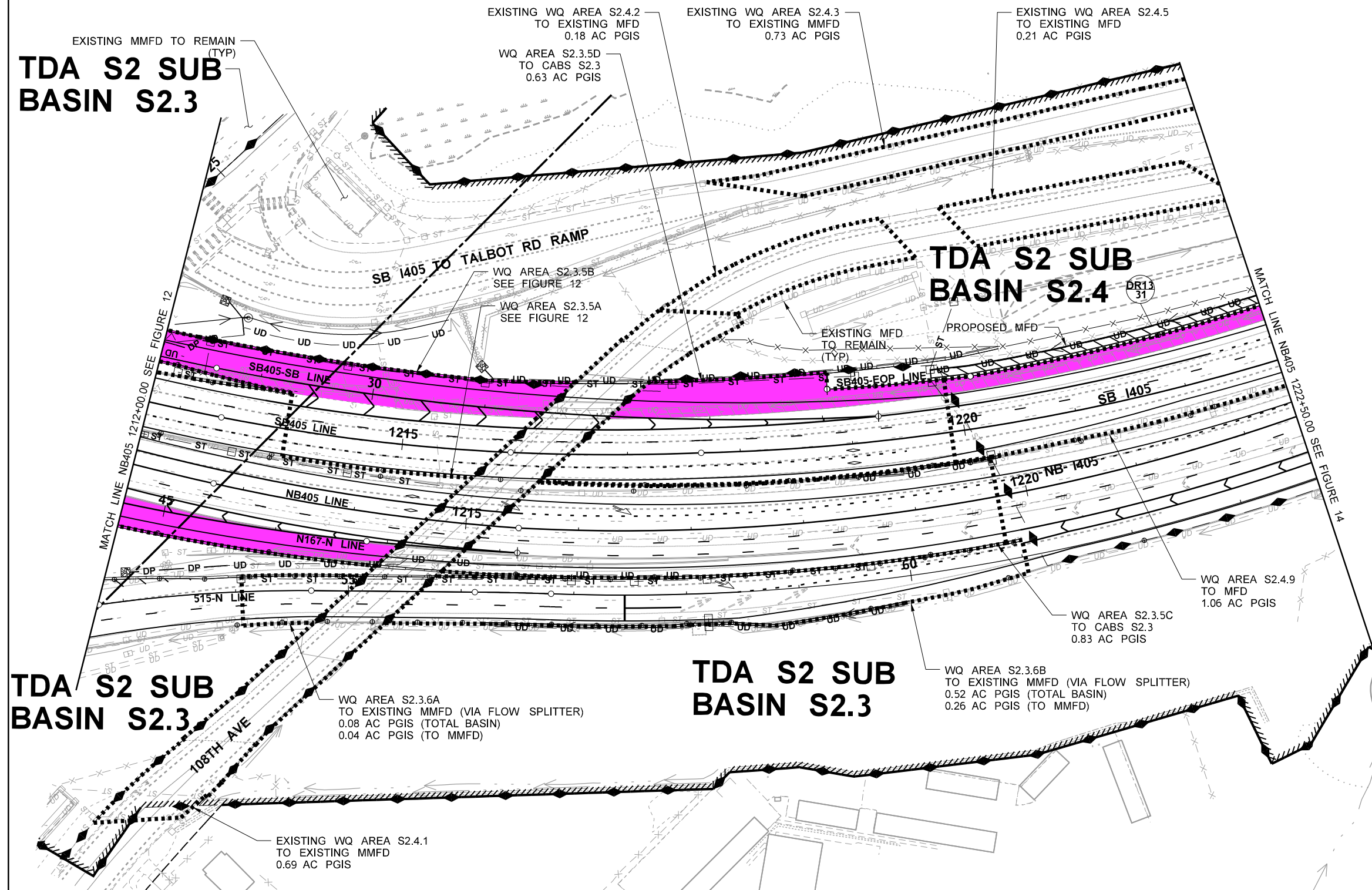


LEGEND	
	TDA BOUNDARY
	NEW PGIS AREA
	NEW NPGIS AREA

FILE NAME c:\pwworking\lna\ x_jzlgweld\0334111\WQ Area-12.dgn														 Washington State Department of Transportation		I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR		PLAN REF NO	
TIME 11:25:38 AM					REGION NO. 10	STATE WASH	FED.AID PROJ.NO.		LOCATION NO.		12								
DATE 1/16/2020					JOB NUMBER										SHEET				
PLOTTED BY JeffZ											OF								
DESIGNED BY					CONTRACT NO.						SHEETS								
ENTERED BY																			
CHECKED BY																			
PROJ. ENGR. C. CHEN																			
REGIONAL ADM. L. ENG					C8811														
REVISION				DATE	BY			DATE		DATE		POST PROJECT WQ AREA							
							P.E. STAMP BOX		P.E. STAMP BOX										




**SEC.19 T.23N. R.5E. W.M. / SEC.20 T.23N. R.5E. W.M.**



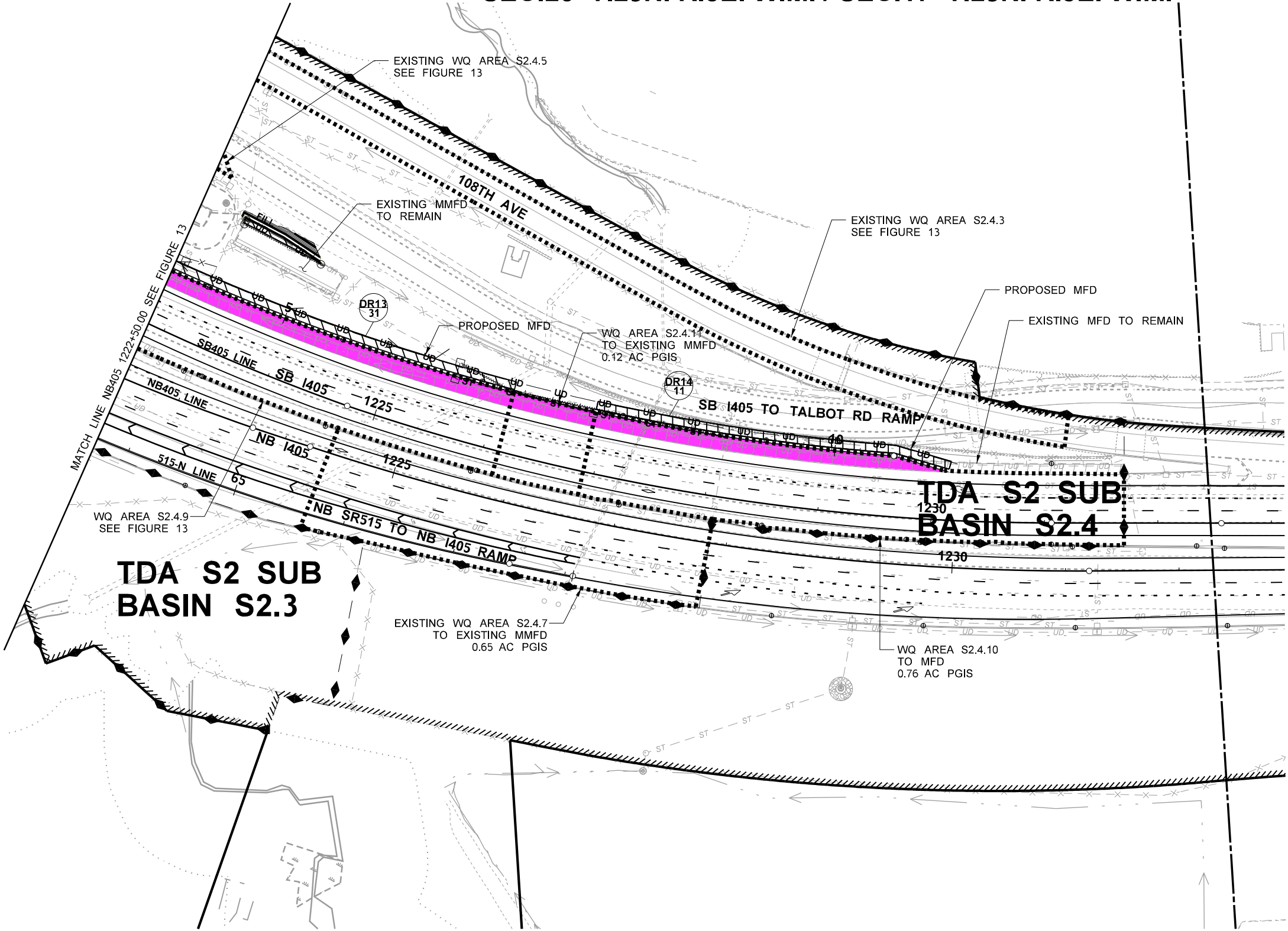
## LEGEND

- ◆ - TDA BOUNDARY
- NEW PGIS AREA
- NEW NPGIS AREA

FILE NAME c:\pwworking\inal_x_jzlgweld\id0334111\WQ Area-13.dgn										<div><p>Washington State Department of Transportation</p></div>		<div>I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR</div>		PLAN REF NO
TIME 11:27:34 AM				REGION NO. 10	STATE WASH	FED.AID PROJ.NO.	13							
DATE 1/16/2020				JOB NUMBER										
PLOTTED BY JeffZ				CONTRACT NO. C8811		LOCATION NO.	SHEET							
DESIGNED BY							OF							
ENTERED BY							SHEETS							
CHECKED BY														
PROJ. ENGR. C. CHEN								<div>POST PROJECT WQ AREA</div>						
REGIONAL ADM. L. ENG		REVISION	DATE	BY										
										P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	




SEC.20 T.23N. R.5E. W.M. / SEC.17 T.23N. R.5E. W.M.



0 50 100  
SCALE IN FEET

LEGEND

- ◆ - TDA BOUNDARY
- NEW PGIS AREA
- NEW NPGIS AREA

FILE NAME c:\pwork\Ingnal_x_jzlgweld\0334111WQ Area-14.dgn														 Washington State Department of Transportation		I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR		PLAN REF NO 14	
TIME 11:31:21 AM										REGION NO. STATE 10 WASH		FED.AID PROJ.NO.							
DATE 1/16/2020										JOB NUMBER									
PLOTTED BY JeffZ												CONTRACT NO.		LOCATION NO.				SHEET	
DESIGNED BY																		OF	
ENTERED BY																		SHEETS	
CHECKED BY																			
PROJ. ENGR. C. CHEN																			
REGIONAL ADM. L. ENG				REVISION		DATE		BY		C8811									
										DATE									
										P.E. STAMP BOX									



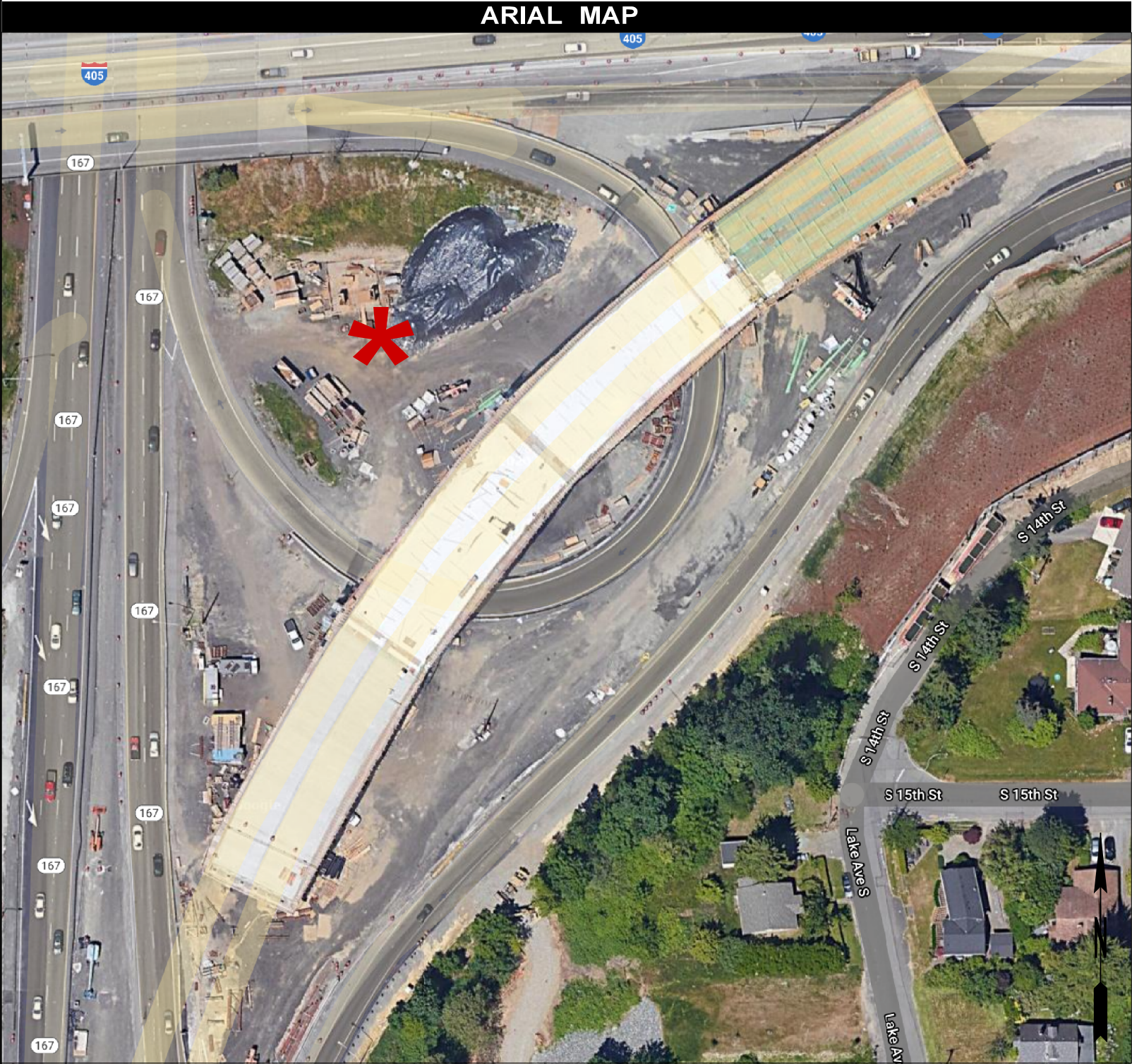
## **APPENDIX B: AS BUILT DRAINAGE PLANS**

To be included for As-Built submittal.

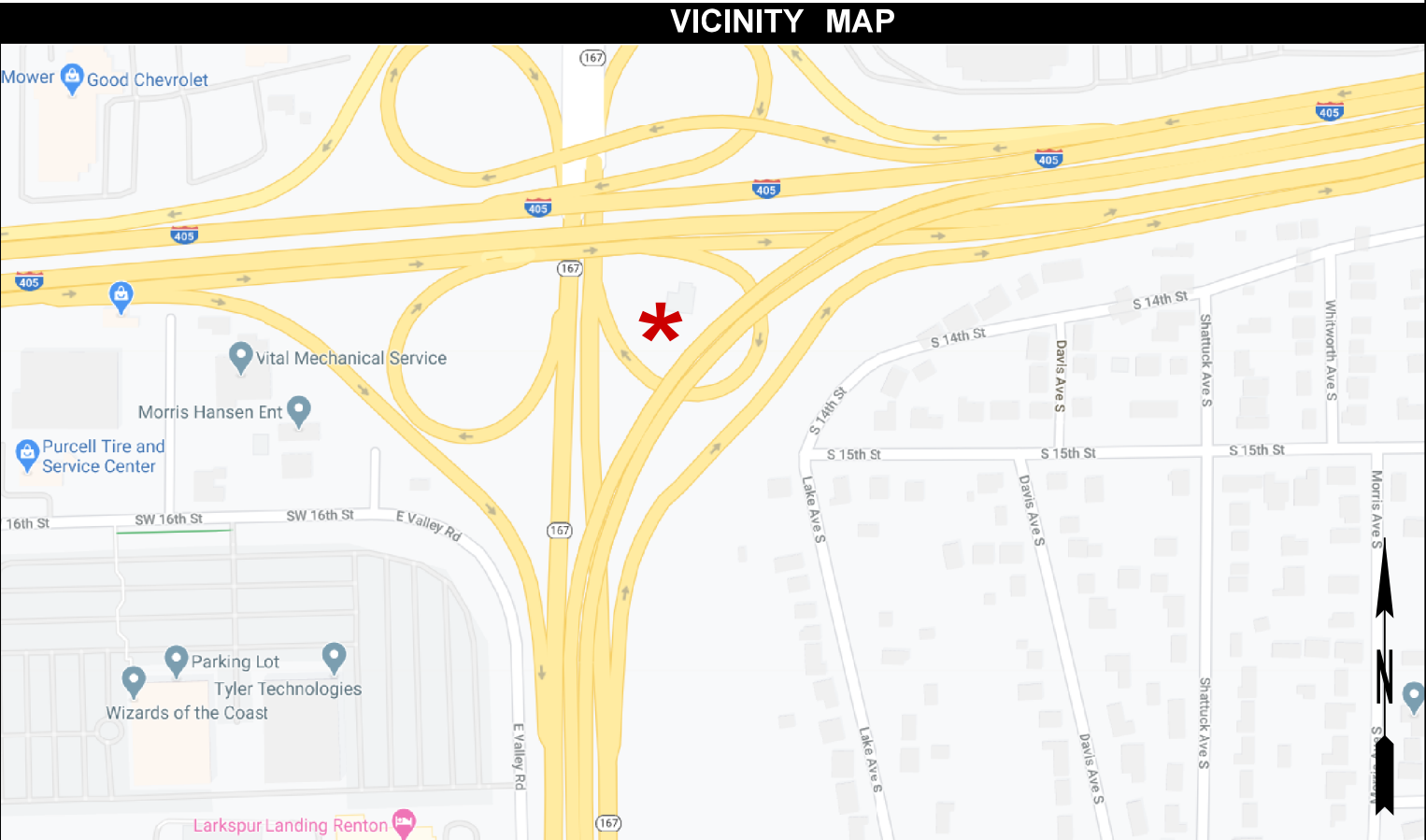


## APPENDIX C: BMP OWNER'S MANUAL SHEETS





SITE INFORMATION	
LOCATION:	SR 167 26.2
FACILITY TYPE:	DETENTION POND
MAINTENANCE RESPONSIBILITY:	WSDOT
DESIGN:	OL-XXXX   CONSTRUCTION: 01XXXX   JOB NUMBER: XXXX
HYDRAULIC REPORT	TBD
MODIFIED BY:	N/A
SITE DESCRIPTION:	THIS IS A 1-CELL FACILITY PROVIDING SEDIMENT REMOVAL AND DETENTION. THIS FACILITY DOES HAVE A GRAVITY DRAIN. THIS FACILITY DOES NOT HAVE A SEDIMENT GAGE. THE CELL IS LINED WITH A GEOMEMBRANE.
AS-BUILT FIELD VERIFICATION:	N/A
SURVEY BENCH MARK:	TBD
FEATURE ANOMALIES:	N/A
DISCLAIMER:	NOTIFY MAINTENANCE SUPERVISOR IF THE BMP IS NOT CHARACTERISTIC OF THIS OWNER'S MANUAL TO FACILITATE MAINTENANCE ACTIVITIES. CONTACT MAINTENANCE SUPERINTENDENT BEFORE ANY MAINTENANCE TAKES PLACE. IF SENSITIVE AREAS OR BUFFERS ARE ADJACENT TO FENCE LINE OR POND BERM, CONTACT NW REGION ENVIRONMENTAL PROGRAM MANAGER OR MAINTENANCE AREA BMP LEAD TECH PRIOR TO STARTING OF WORK. LET ANY POND WATER SETTLE FOR DISTURBED POND AREAS PRIOR TO DISCHARGING. FOR PONDS WHERE RISK OF OVER TOPPING EXISTINGS, WATER MAY NEED TO BE TREATED BEFORE DISCHARGE. GRAVEL FILTERS ARE TO BE PROTECTED FROM TURBID WATER DURING MAINTENANCE WORK. FOLLOW REQUIREMENTS FOR CONSTRUCTION TESC.
DIRECTIONS:	







NO.	ITEM	PURPOSE
1	ACCESS ROAD	SAFE, CLEAR ACCESS TO SITE WITH PROPER SITE IDENTIFICATION SIGNING.
2	PERIMETER VEGETATION	STABILIZE SLOPES AND PREVENT EROSION.
3	INFLOW STRUCTURE	ALLOWS STORMWATER INTO THE FACILITY WITH ENERGY DISSIPATION TO AVOID EROSION.
4	DETENTION CELL	PROVIDE TEMPORARY STORAGE OF STORMWATER FOLLOWING A STORM EVENT.
5	OUTFLOW STRUCTURE	CONTROLS THE RELEASE RATE TO MINIMIZE THE EFFECTS ON THE DOWNSTREAM SYSTEM.
6	EMERGENCY SPILLWAY	PROTECTS THE FACILITY AGAINST DAMAGE FROM THE 100 YEAR AND LARGER EVENTS.
7	PERIMETER EMBANKMENT	PROVIDES STRUCTURALLY SOUND CONTAINMENT OF THE CELL DUE TO SLOPING TOPOGRAPHY.

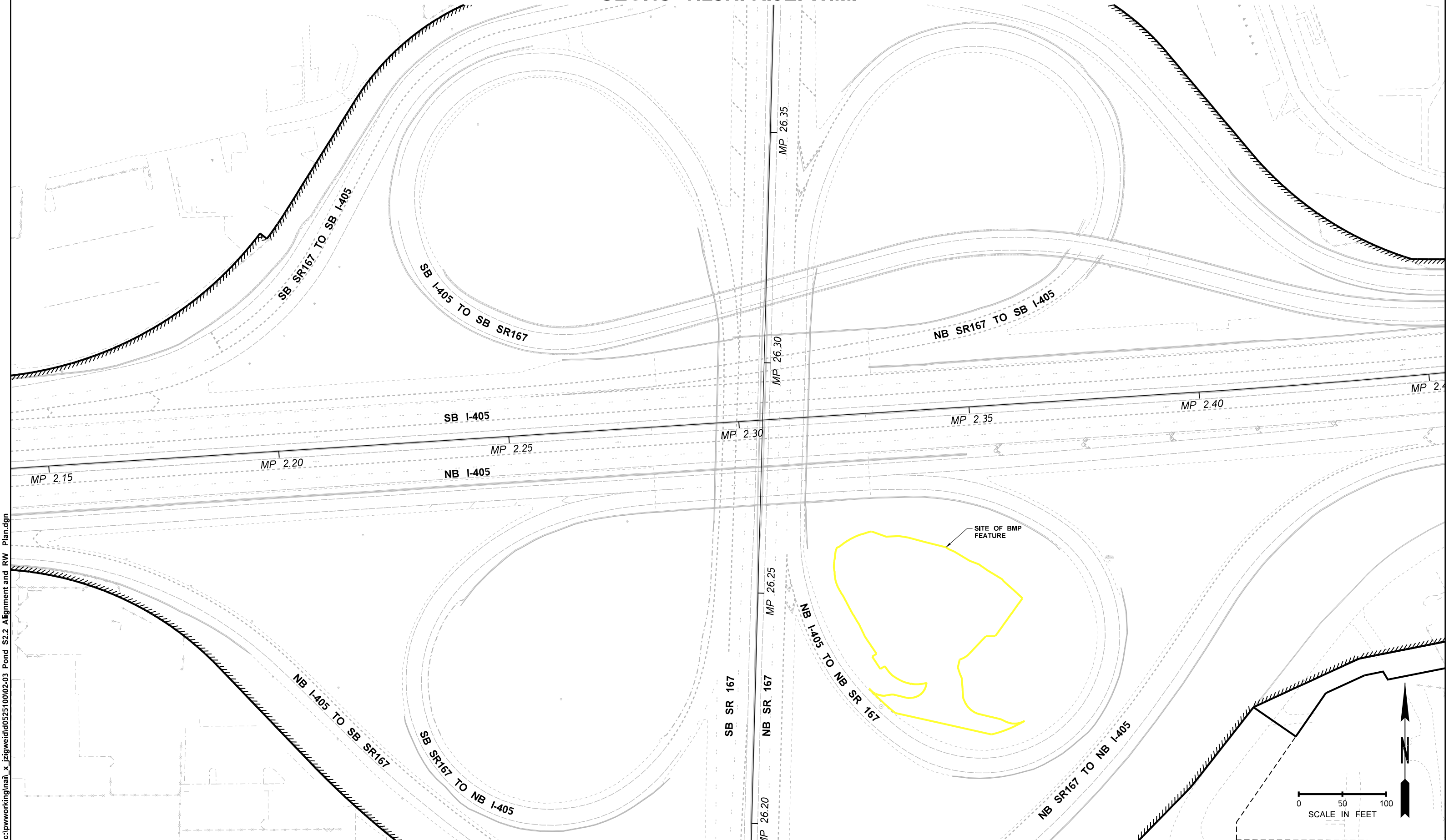
NO.	ITEM	BMP MAINTENANCE ACTIVITY
NOTE: THE FOLLOWING ITEMS SUPPLEMENT HRM TABLES 5-12 THROUGH 5-24. REFER TO TABLES 5-12 THROUGH 5-24 FOR GENERAL MAINTENANCE ACTIVITIES.		
1	ACCESS ROAD	REMOVE A MINIMUM AMOUNT OF VEGETATION TO PROVIDE CLEAR ACCESS ALONG ACCESS ROAD.
2	PERIMETER VEGETATION	DO NOT REMOVE PLANTED OR NATURAL RECRUITMENT TREES IF THEY DO NOT INTERFERE WITH ACCESS. REMOVE INVASIVE WEEDS USING IVM METHODS.
3	INFLOW STRUCTURE	REFER TO HRM TABLES 5-12 THROUGH 5-24.
4	DETENTION CELL	IF SEDIMENT REMOVAL IS REQUIRED, REMOVE VEGETATION IN CONCURRENCE WITH SEDIMENT REMOVAL.
5	OUTFLOW STRUCTURE	REFER TO HRM TABLES 5-12 THROUGH 5-24.
6	EMERGENCY SPILLWAY	REMOVE ALL VEGETATION FROM EMERGENCY SPILLWAY.
7	PERIMETER EMBANKMENT	SEED EXPOSED SOILS WITH NATIVE SEED MIX OR COVER WITH WOOD MULCH.

LEGEND	
	- DRAINAGE STRUCTURE ID CONTINUED
	- STORM SEWER PIPE
	- CATCH BASIN
	- GRATE INLET
	- DROP INLET
	- MANHOLE
	- ROCK OUTFALL PROTECTION
	- DRAINAGE DITCH
	- EXISTING STORM TO BE REMOVED OR ABANDONED

c:\pwworking\atl\_x\_jzgweid\052510002-02 Pond S2.2 Maintenance Plan.dgn



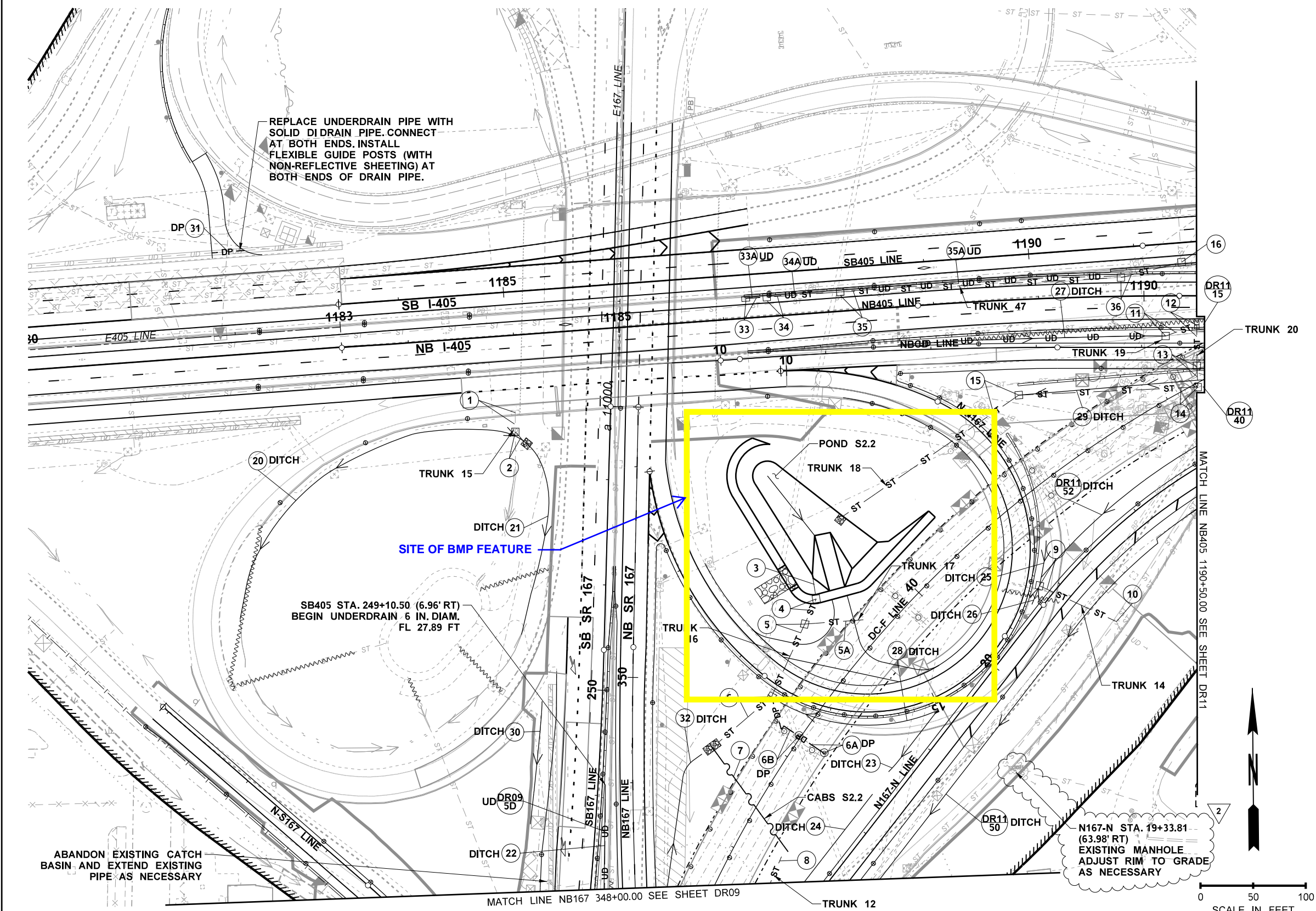
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







**SEC.19 T.23N. R.5E. W.M.**





DRAINAGE REFERENCE SUMMARY		
DESCRIPTION	PROFILE/DETAIL	SHEET(S)
TRUNK 12	DP07	
TRUNK 14	DP07	
TRUNK 15	DP08	
TRUNK 16	DP08	
TRUNK 17	DP08	
TRUNK 18	DP09A, DP09B	
TRUNK 19	DP10	
TRUNK 20	DP10	
TRUNK 47	DP25	
POND S2.2	DD10A, DD10B, DD10C	
CABS S2.2	DD20	
DRAIN PIPE DR10-6A	BRIDGE PLANS	
DRAIN PIPE DR10-6B	BRIDGE PLANS	
DITCH DR10-29	DH01	
DITCH DR10-32	DD20	

ATKINSON  
MAY 28 2019 RTW  
RELEASED FOR CONSTRUCTION

## LEGEND

	- DRAINAGE STRUCTURE ID
	- DRAINAGE STRUCTURE ID CONTINUED
	- STORM SEWER PIPE
	- UNDERDRAIN PIPE
	- DRAIN PIPE
	- CATCH BASIN
	- GRATE INLET
	- DROP INLET
	- MANHOLE
	- ROCK OUTFALL PROTECTION
	- DRAINAGE DITCH
	- COMPOST AMENDED BIOFILTRATION SWALE
	- MEDIA FILTER DRAIN
	- EXISTING STORM TO BE REMOVED OR ABANDONED

FILE NAME c:\pwworking\nai_x_grimandold0321992\C8811_PS_DR10.dgn												 Washington State Department of Transportation		I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR		PLAN REF NO.
TIME	9:22:17 AM				REGION NO.	STATE	FED.AID PROJ.NO.	DR10								
DATE	5/24/2019				10	WASH							SHEET			
PLOTTED BY	GlennR	REV. 2 - RFI0369	5/24/19		JOB NUMBER								OF			
DESIGNED BY	J. TURCOTT	REV. 1 - RFI0293	7/9/18		CONTRACT NO.								SHEETS			
ENTERED BY	E. JACKSON	REV. 0 - RFC	6/16/17													
CHECKED BY	J. ZIGWEID	REV. B - FINAL REVIEW	4/14/17		C8811		LOCATION NO.									
PROJ. ENGR.	C. CHEN	REV. A - PRELIMINARY REVIEW	1/27/17													
REGIONAL ADM.	L. ENG	REVISION	DATE	BY												



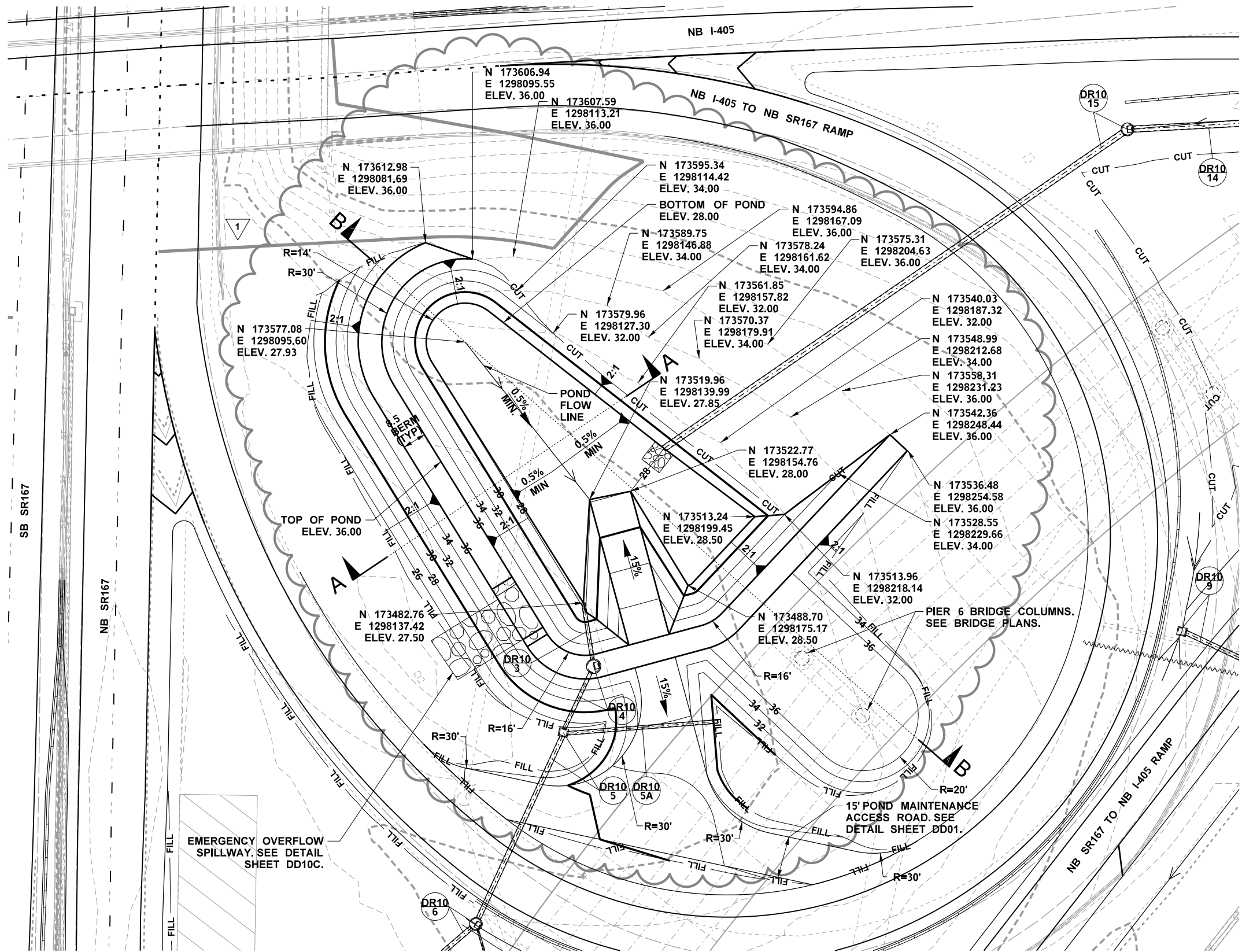










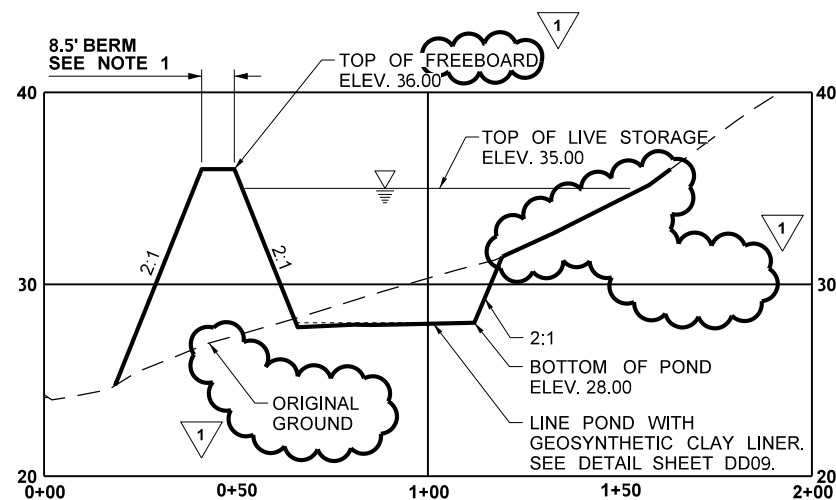
SEC.19 T.23N. R.5E. W.M.



ATKINSON  
JUL 11 2018 *PSA*  
RELEASED FOR CONSTRUCTION

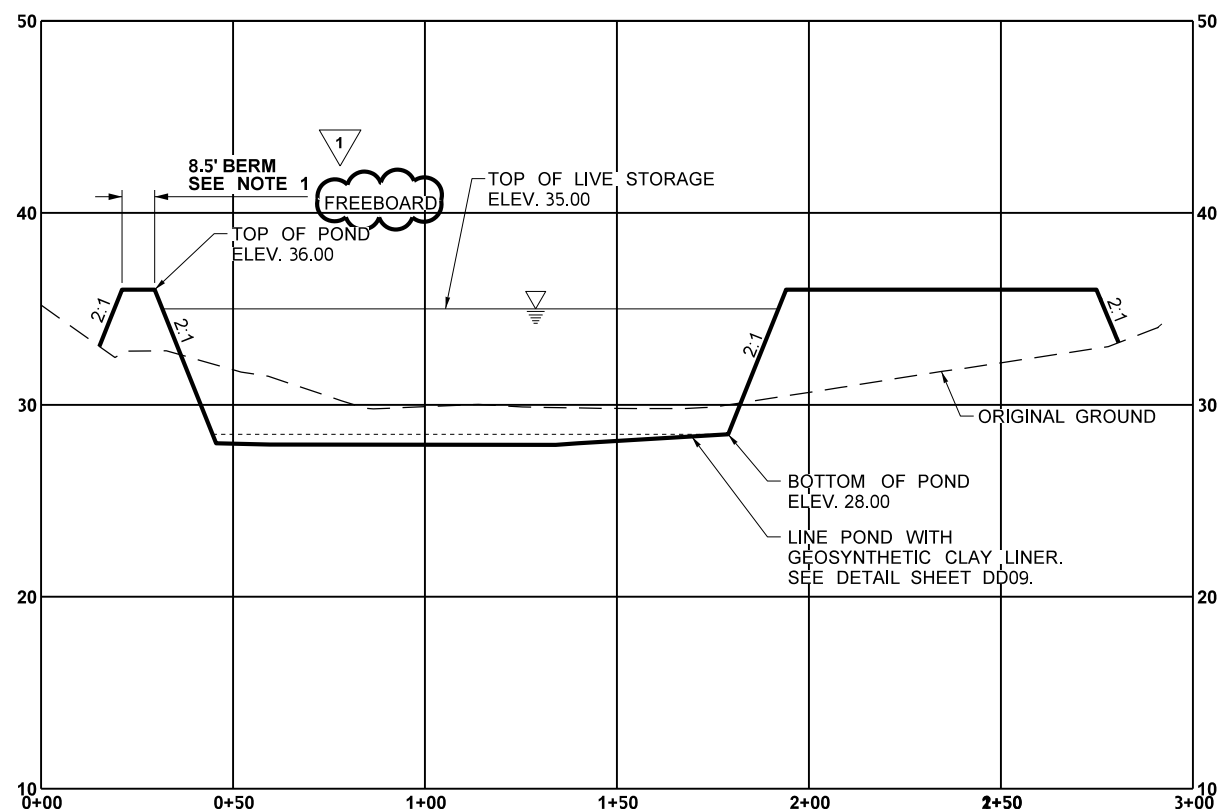
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DATE 7/9/2018					JOB NUMBER		CONTRACT NO.		LOCATION NO.		C8811	BY					SHEET			
PLOTTED BY SMesic	REV. 1 - RFI0293	7/9/18																		
DESIGNED BY J. TURCOTT	REV. 0 - RFC	6/16/17															OF SHEETS			
ENTERED BY E. JACKSON	REV. B - FINAL REVIEW	4/14/17																		
CHECKED BY J. ZIGWEID	REV. A - PRELIMINARY REVIEW	1/27/17																		
PROJ. ENGR. C. CHEN	REVISION																			
REGIONAL ADM. L. ENG																				





**SECTION A-A (POND S2.2)**

HORIZ: 1"=50'  
VERT: 1"=10'

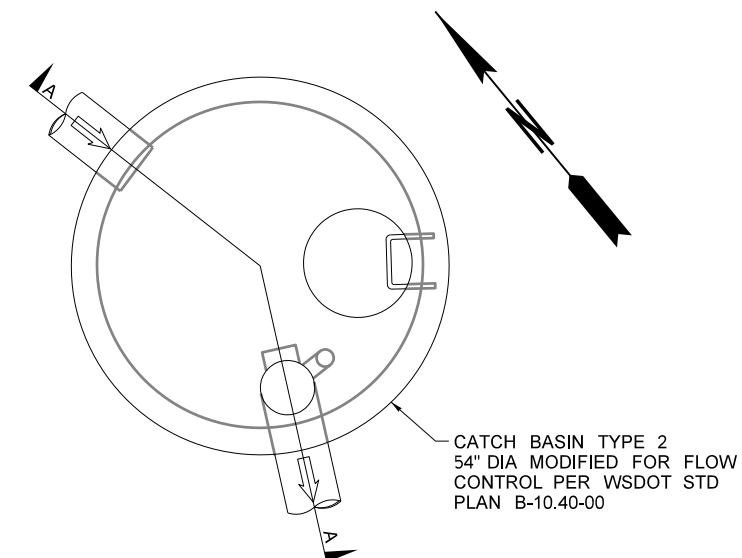


**SECTION B-B (POND S2.2)**

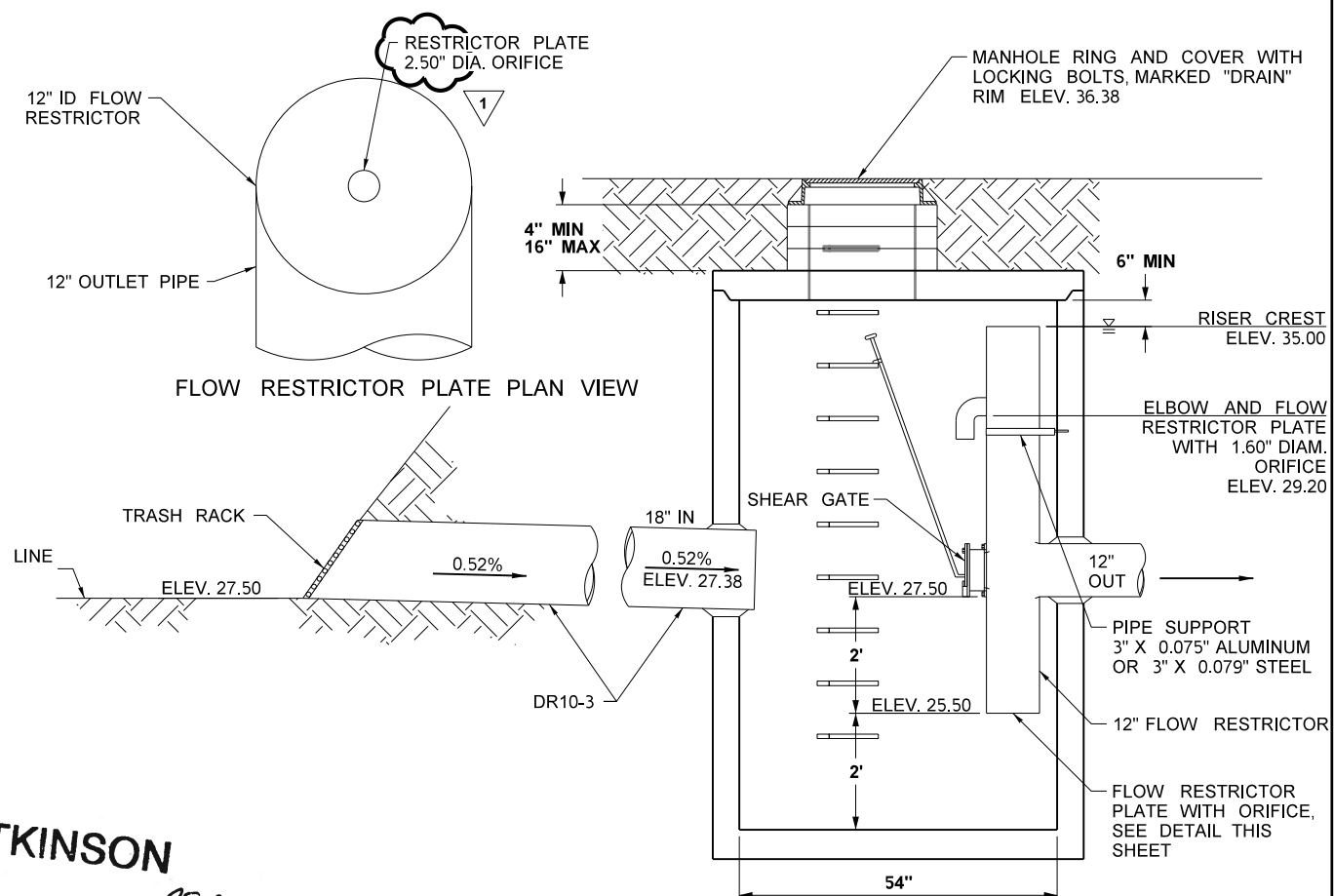
HORIZ: 1"=50'  
VERT: 1"=10'

**POND BERM NOTE:**

1. THE BERM SHALL BE CONSTRUCTED IN ACCORDANCE WITH SECTION 9.2.2 OF THE WSDOT GDM AND SECTIONS 2.2.2 AND 2.3.7 OF THE WASHINGTON STATE DEPARTMENT OF ECOLOGY DAM SAFETY OFFICE (DSO) DAM SAFETY GUIDELINES. POND BERM FILL WILL CONSIST OF EMBANKMENT MATERIAL AS SPECIFIED IN SECTION 5-4.1.4 OF THE 2014 HIGHWAY RUNOFF MANUAL (A MIN. OF 30 PERCENT CLAY, A MAX. OF 60 PERCENT SAND, A MAX. OF 60 PERCENT SILT AND NEGLIGIBLE GRAVEL AND COBBLE) AND COMPACTED PER SECTION 2-03.3(14)C METHOD C.



DR10-4 PLAN VIEW



DR10-4 SECTION A-A

**CONTROL STRUCTURE DETAIL**

N.T.S.

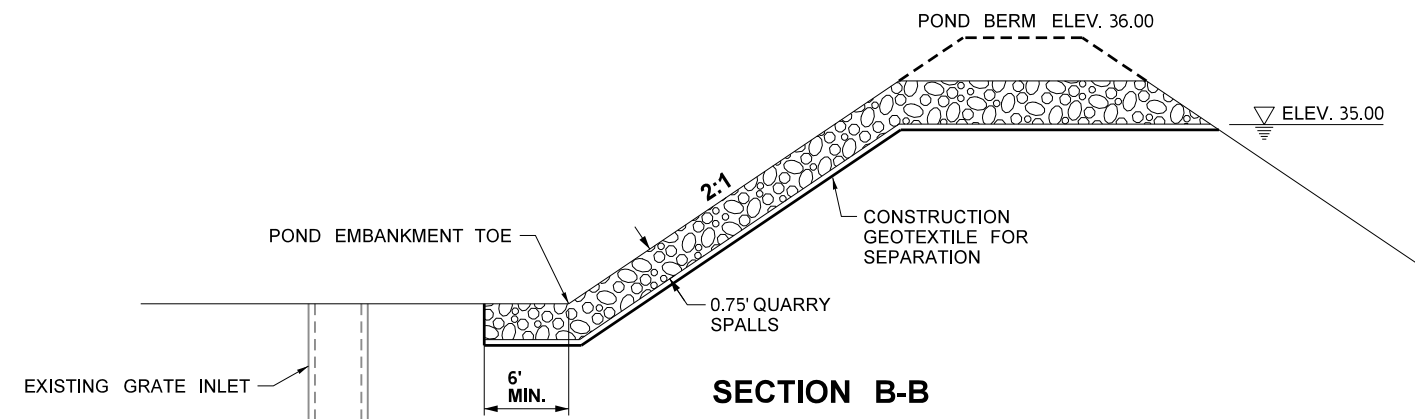
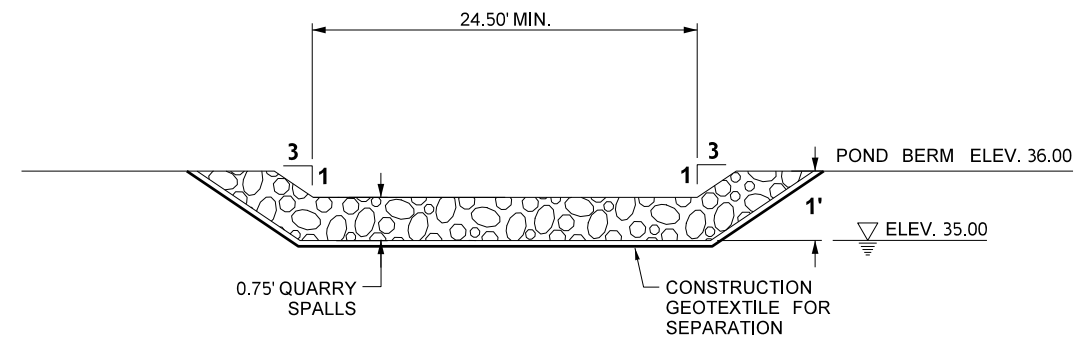
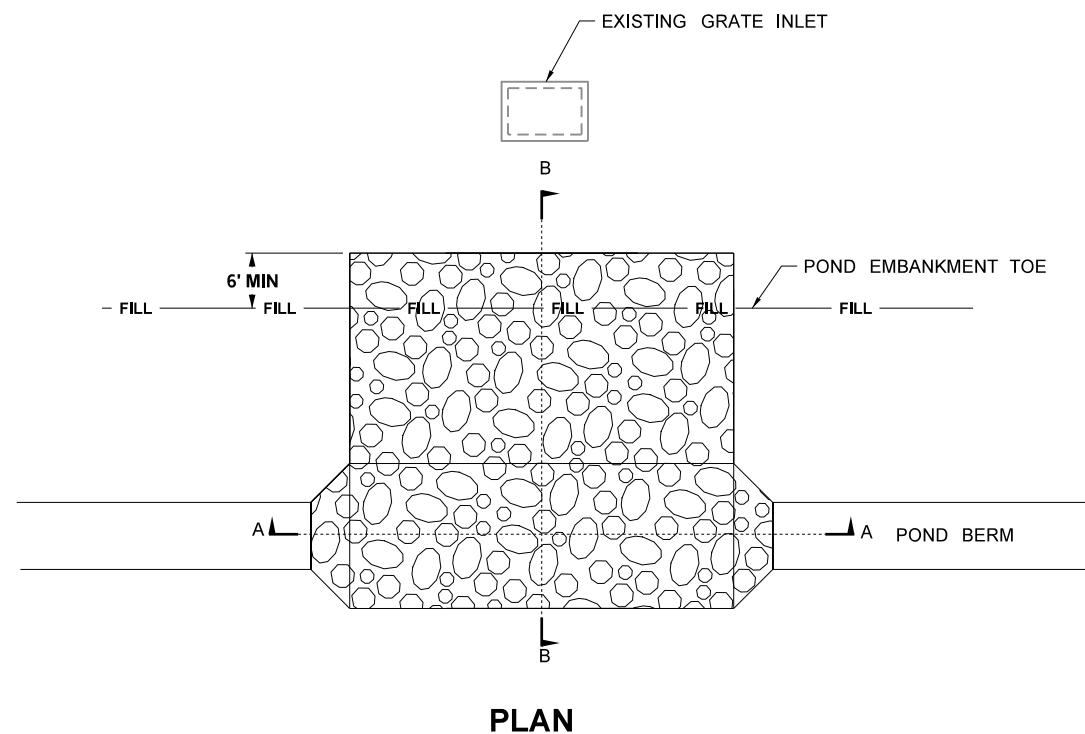
ATKINSON

JUL 11 2018 PSB

RELEASED FOR CONSTRUCTION

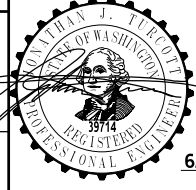

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DESIGNED BY										J. TURCOTT									
ENTERED BY										E. JACKSON									
CHECKED BY										J. ZIGWEID									
PROJ. ENGR.										C. CHEN									
REGIONAL ADM.										L. ENG									
										REVISION									
										DATE									
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										C8811									
										FED.AID PROJ.NO.									
										10 WASH									
										JOB NUMBER									
										CONTRACT NO.									
										LOCATION NO.									
										C8811									
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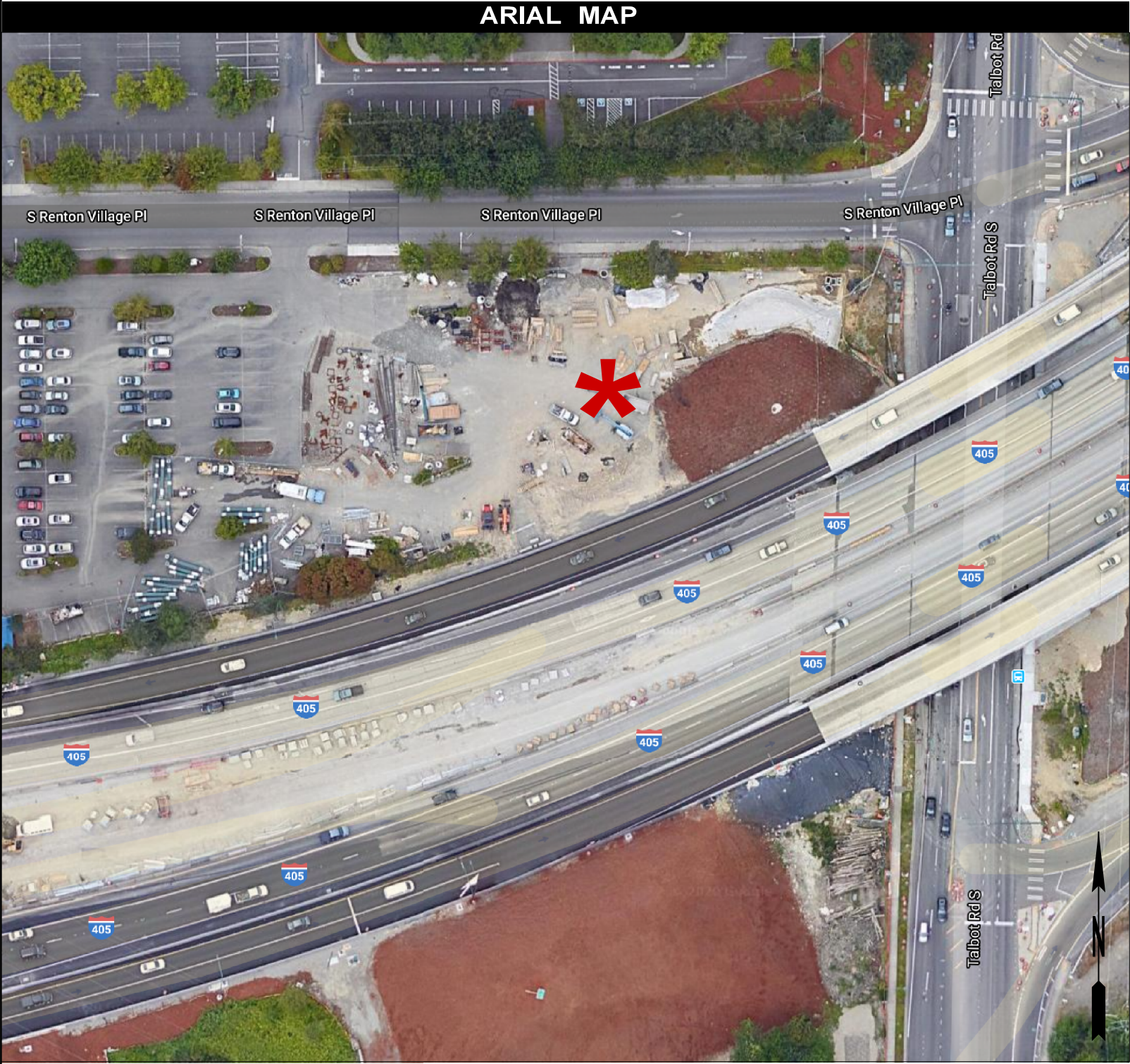


**POND S2.2 EMERGENCY OVERFLOW SPILLWAY DETAIL**  
N.T.S.

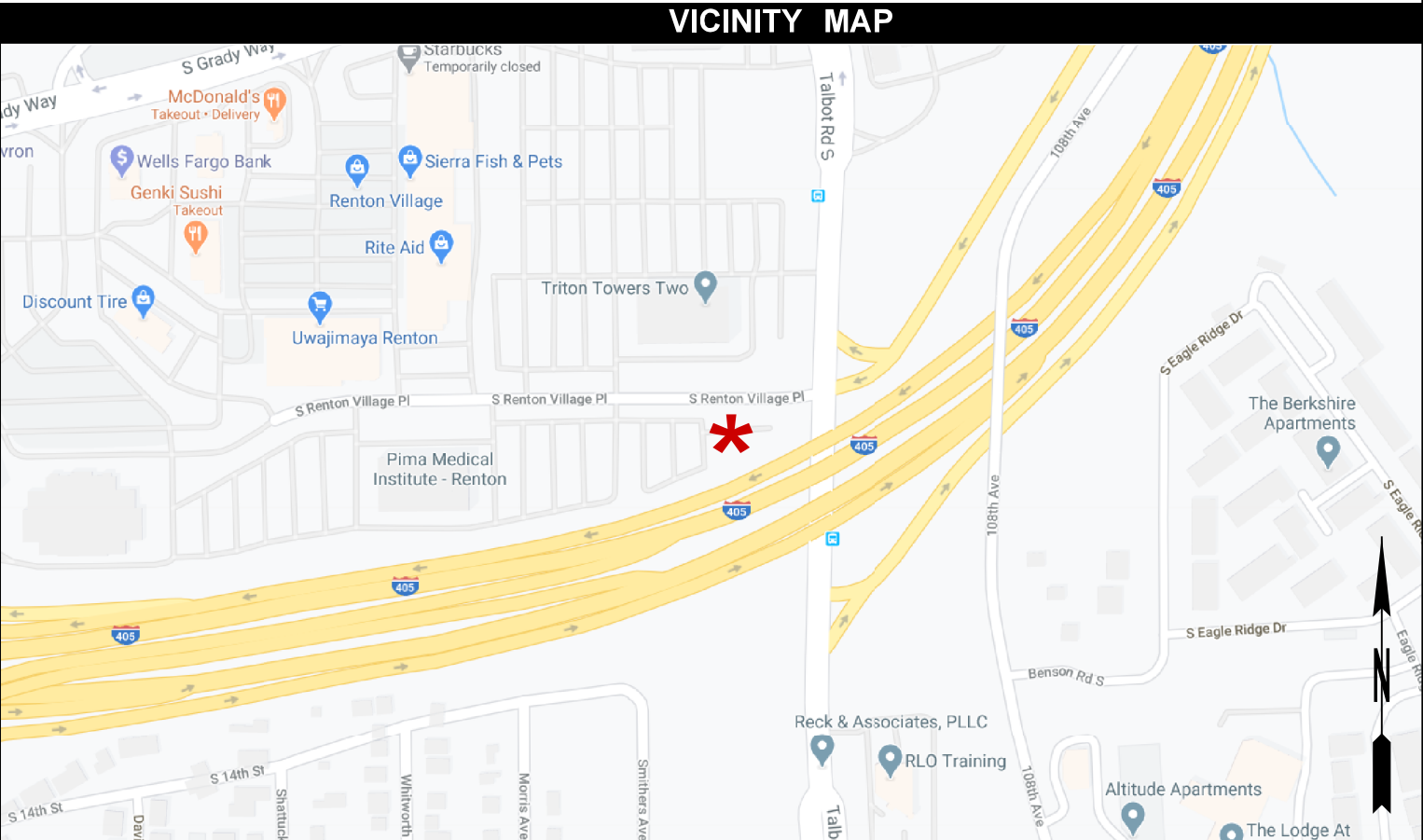
**ATKINSON**  
JUN 15 2017 *RSA*  
RELEASED FOR CONSTRUCTION

FILE NAME	c:\pwworking\atl_x_ejackson\0321992\C8811_DE_DD10C.dgn			REGION NO.	STATE	FED.AID PROJ.NO.		P.E. STAMP BOX	DATE	 Washington State Department of Transportation	I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR	PLAN REF NO
TIME	1:15:35 PM			10	WASH							DD10C
DATE	6/8/2017											SHEET
PLOTTED BY	EJackson											OF
DESIGNED BY	J. TURCOTT						C8811				POND S2.2 DETAILS	SHEETS
ENTERED BY	E. JACKSON	REV. 0 - RFC	6/16/17									
CHECKED BY	J. ZIGWEID	REV. B - FINAL REVIEW	4/14/17									
PROJ. ENGR.	C. CHEN	REV. A - PRELIMINARY REVIEW	1/27/17									
REGIONAL ADM.	L. ENG	REVISION	DATE	BY								

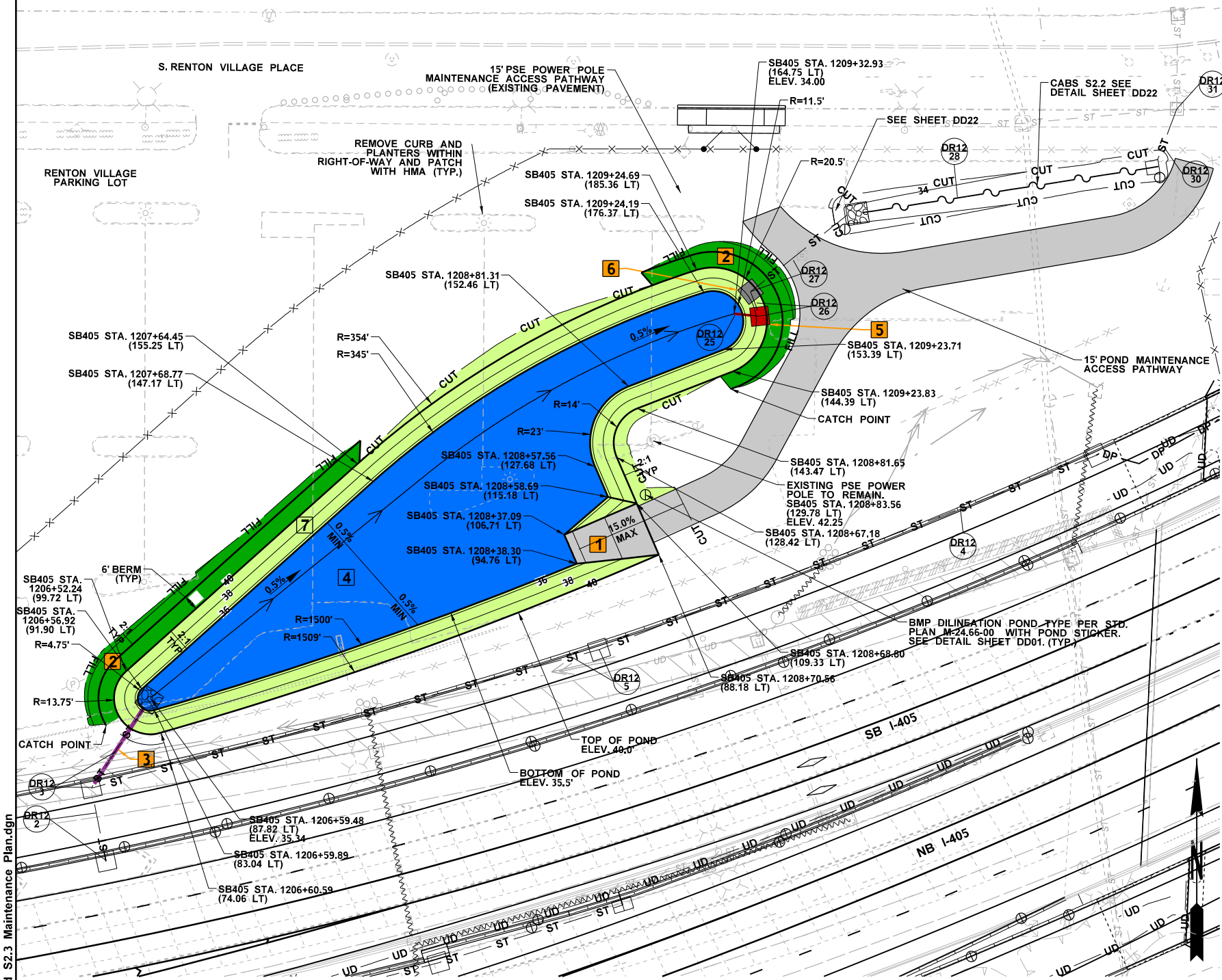




SITE INFORMATION	
LOCATION:	I-405 MP 2.8
FACILITY TYPE:	DETENTION POND
MAINTENANCE RESPONSIBILITY:	WSDOT
DESIGN:	OL-XXXX   CONSTRUCTION: 01XXXX   JOB NUMBER: XXXX
HYDRAULIC REPORT	TBD
MODIFIED BY:	N/A
SITE DESCRIPTION:	THIS IS A 1-CELL FACILITY PROVIDING SEDIMENT REMOVAL AND DETENTION. THIS FACILITY DOES HAVE A GRAVITY DRAIN. THIS FACILITY DOES NOT HAVE A SEDIMENT GAGE. THE CELL IS LINED WITH A GEOMEMBRANE.
AS-BUILT FIELD VERIFICATION:	N/A
SURVEY BENCH MARK:	TBD
FEATURE ANOMALIES:	N/A
DISCLAIMER:	NOTIFY MAINTENANCE SUPERVISOR IF THE BMP IS NOT CHARACTERISTIC OF THIS OWNER'S MANUAL TO FACILITATE MAINTENANCE ACTIVITIES. CONTACT MAINTENANCE SUPERINTENDENT BEFORE ANY MAINTENANCE TAKES PLACE. IF SENSITIVE AREAS OR BUFFERS ARE ADJACENT TO FENCE LINE OR POND BERM, CONTACT NW REGION ENVIRONMENTAL PROGRAM MANAGER OR MAINTENANCE AREA BMP LEAD TECH PRIOR TO STARTING OF WORK. LET ANY POND WATER SETTLE FOR DISTURBED POND AREAS PRIOR TO DISCHARGING. FOR PONDS WHERE RISK OF OVER TOPPING EXISTINGS, WATER MAY NEED TO BE TREATED BEFORE DISCHARGE. GRAVEL FILTERS ARE TO BE PROTECTED FROM TURBID WATER DURING MAINTENANCE WORK. FOLLOW REQUIREMENTS FOR CONSTRUCTION TESC.
DIRECTIONS:	





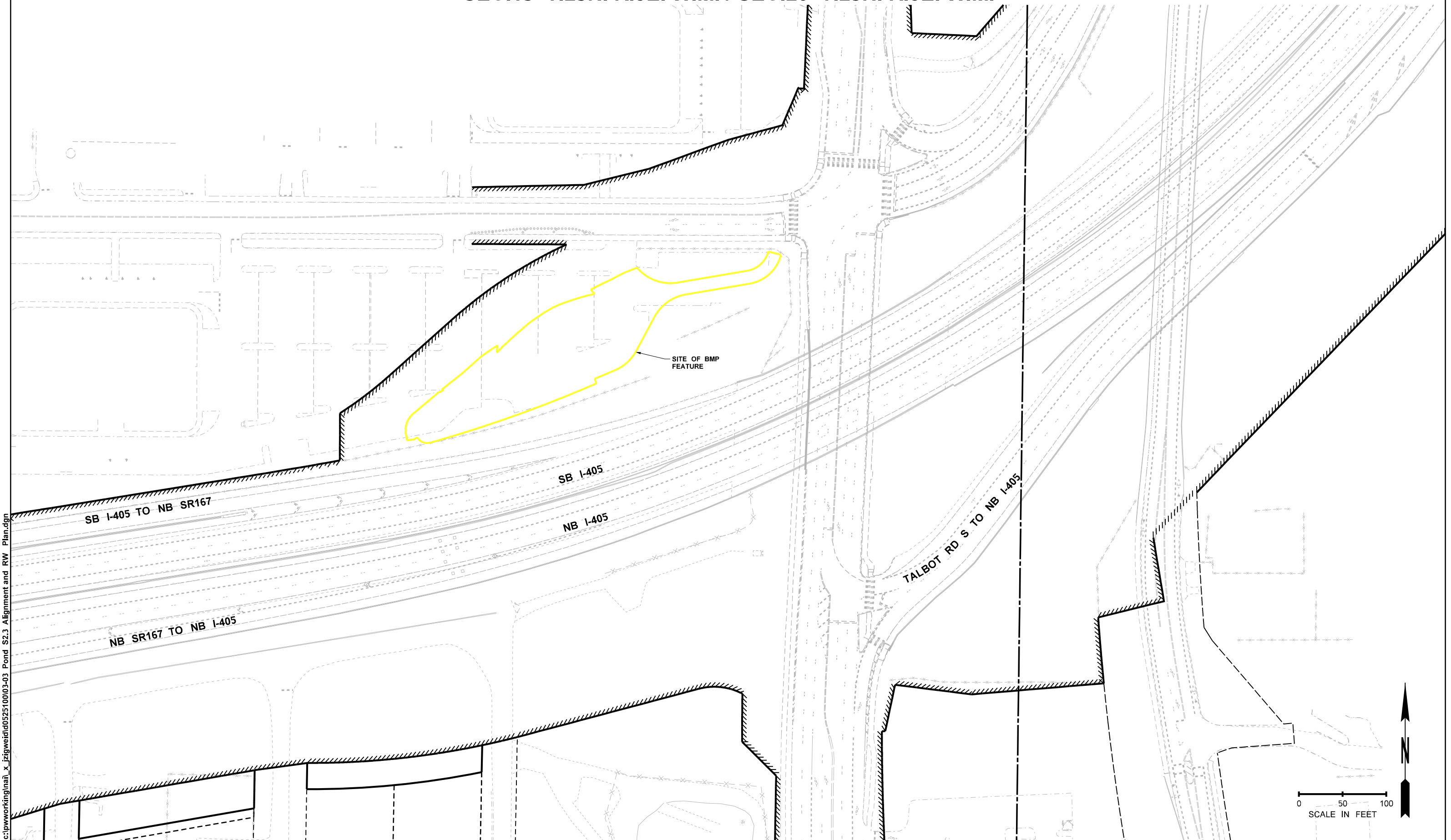


NO.	ITEM	PURPOSE
1	ACCESS ROAD	SAFE, CLEAR ACCESS TO SITE WITH PROPER SITE IDENTIFICATION SIGNING.
2	PERIMETER VEGETATION	STABILIZE SLOPES AND PREVENT EROSION.
3	INFLOW STRUCTURE	ALLOWS STORMWATER INTO THE FACILITY WITH ENERGY DISSIPATION TO AVOID EROSION.
4	DETENTION CELL	PROVIDE TEMPORARY STORAGE OF STORMWATER FOLLOWING A STORM EVENT.
5	OUTFLOW STRUCTURE	CONTROLS THE RELEASE RATE TO MINIMIZE THE EFFECTS ON THE DOWNSTREAM SYSTEM.
6	OVERFLOW STRUCTURE	PROTECTS THE FACILITY AGAINST DAMAGE FROM THE 100 YEAR AND LARGER EVENTS.
7	PERIMETER EMBANKMENT	PROVIDES STRUCTURALLY SOUND CONTAINMENT OF THE CELL DUE TO SLOPING TOPOGRAPHY.

NO.	ITEM	BMP MAINTENANCE ACTIVITY
NOTE: THE FOLLOWING ITEMS SUPPLEMENT HRM TABLES 5-12 THROUGH 5-24. REFER TO TABLES 5-12 THROUGH 5-24 FOR GENERAL MAINTENANCE ACTIVITIES.		
1	ACCESS ROAD	REMOVE A MINIMUM AMOUNT OF VEGETATION TO PROVIDE CLEAR ACCESS ALONG ACCESS ROAD.
2	PERIMETER VEGETATION	DO NOT REMOVE PLANTED OR NATURAL RECRUITMENT TREES IF THEY DO NOT INTERFERE WITH ACCESS. REMOVE INVASIVE WEEDS USING IVM METHODS.
3	INFLOW STRUCTURE	REFER TO HRM TABLES 5-12 THROUGH 5-24.
4	DETENTION CELL	IF SEDIMENT REMOVAL IS REQUIRED, REMOVE VEGETATION IN CONCURRENCE WITH SEDIMENT REMOVAL.
5	OUTFLOW STRUCTURE	REFER TO HRM TABLES 5-12 THROUGH 5-24.
6	OVERFLOW STRUCTURE	REFER TO HRM TABLES 5-12 THROUGH 5-24.
7	PERIMETER EMBANKMENT	SEED EXPOSED SOILS WITH NATIVE SEED MIX OR COVER WITH WOOD MULCH.

LEGEND	
	- DRAINAGE STRUCTURE ID CONTINUED
	- STORM SEWER PIPE
	- CATCH BASIN
	- GRATE INLET
	- DROP INLET
	- MANHOLE
	- ROCK OUTFALL PROTECTION
	- DRAINAGE DITCH
	- COMPOST AMENDED BIOFILTRATION SWALE
	- EXISTING STORM TO BE REMOVED OR ABANDONED







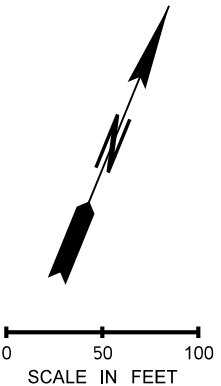
SEC.19 T.23N. R.5E. W.M.

DRAINAGE REFERENCE SUMMARY

DESCRIPTION	PROFILE/DETAIL SHEET(S)
TRUNK 18	DP09A, DP09B
TRUNK 22	DP11
TRUNK 23	DP12
TRUNK 25	DP13
TRUNK 32	DP16
TRUNK 33	DP16
TRUNK 34	DP16
TRUNK 35	DP17
TRUNK 36	DP18
TRUNK 37	DP19
TRUNK 38	DP19
TRUNK 39	DP20
POND S2.3	DD11A, DD11B
CABS S2.3	DD22
DRAIN PIPE DR12-12C	DP54
DRAIN PIPE DR12-14B	DP54
DRAIN PIPE DR12-18B	DP54
DRAIN PIPE DR12-44B	DP55
DRAIN PIPE DR12-19B	DP56

NOTES:

- SEE PLAN SHEET DD141-DD145 AND DP141-DP142 FOR DRAINAGE RELATED WORK ON 14TH ST.
- SEE DRAINAGE PLAN ENLARGEMENTS SHEETS DD30-DD33.



LEGEND

- ① - DRAINAGE STRUCTURE ID
- DR01 ① - DRAINAGE STRUCTURE ID CONTINUED
- ST — ST — STORM SEWER PIPE
- UD — UD — UNDERDRAIN PIPE
- DP — DP — DRAIN PIPE
- - CATCH BASIN
- ▣ - GRATE INLET
- ▤ - DROP INLET
- - MANHOLE
- ▣ - ROCK OUTFALL PROTECTION
- - DRAINAGE DITCH
- ~ - COMPOST AMENDED BIOFILTRATION SWALE
- ▨ - MEDIA FILTER DRAIN
- ~~~~~ - EXISTING STORM TO BE REMOVED OR ABANDONED

ATKINSON

JUL 24 2019 KTW

RELEASED FOR CONSTRUCTION

FILE NAME c:\pwworking\atl\_x\_jzigweid\0321992\0321992\PS\_DR12.dgn

TIME 10:11:02 AM

DATE 7/23/2019

PLOTTED BY JeffZ

DESIGNED BY J. TURCOTT

ENTERED BY E. JACKSON

CHECKED BY J. ZIGWEID

PROJ. ENGR. C. CHEN

REGIONAL ADM. L. ENG

REV. 6 - RFI0373 & RFI0374

REV. 5 - RFI0367

REV. 4 - RFI0252

REV. 3 - RFI0242

REV. 2 - RFI0202

REV. 1 - RFI0057

REV. 0 - RFC

REVISION

7/16/19

5/1/19

4/6/18

3/19/18

1/15/18

6/16/17

6/02/17

DATE

BY

REGION NO.

STATE

10 WASH

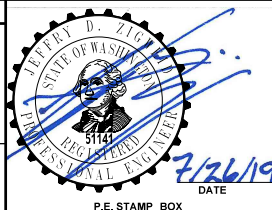
JOB NUMBER

CONTRACT NO.

C8811

FED.AID PROJ.NO.

LOCATION NO.



P.E. STAMP BOX

DATE



I-405 / SR 167 INTERCHANGE  
DIRECT CONNECTOR

DRAINAGE PLAN

PLAN REF NO

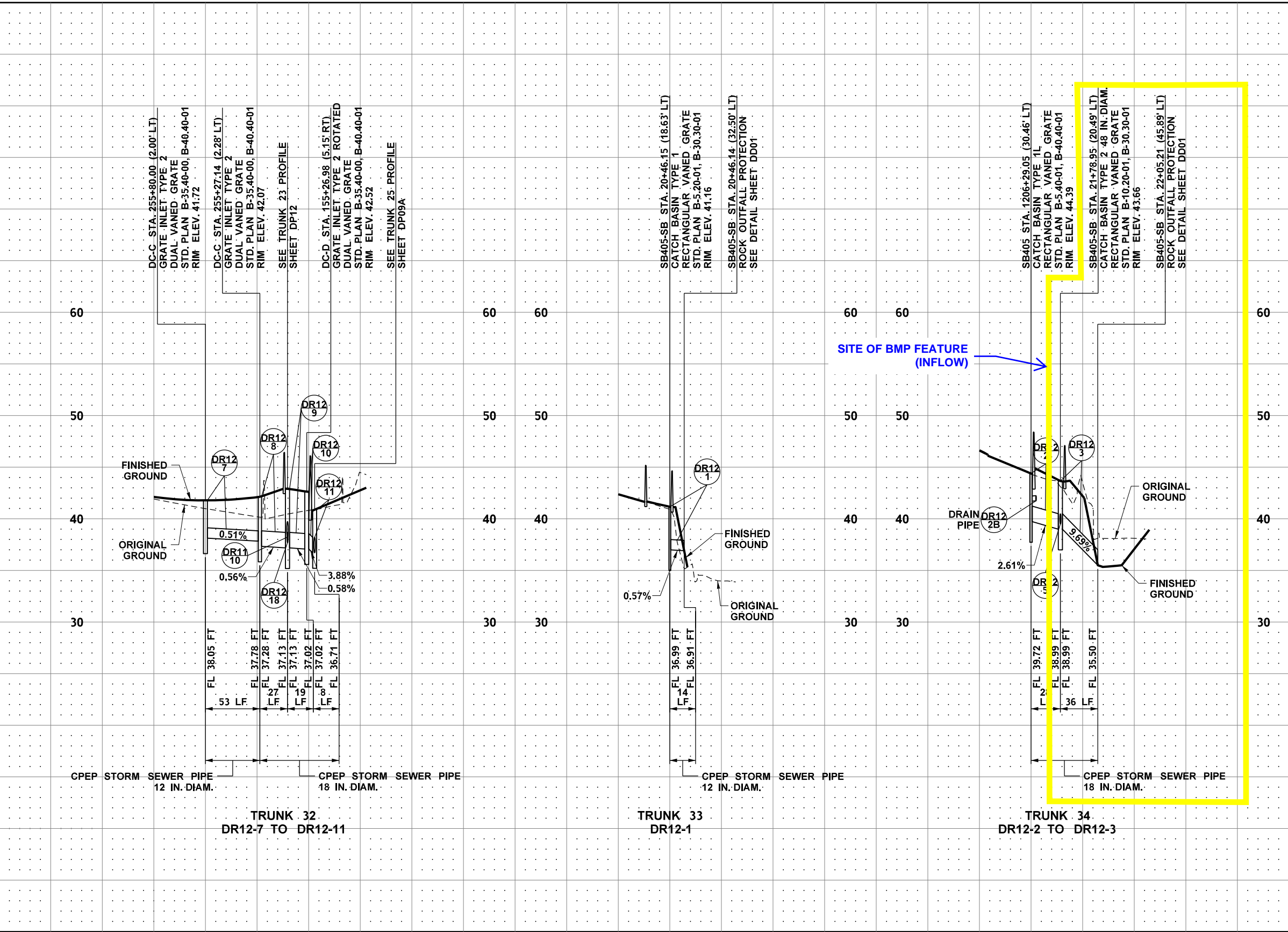
DR12

SHEET

OF

SHEETS







**NOTES:**

1. STATION, OFFSET, AND RIM ELEVATION FOR STRUCTURES ARE CENTER OF STRUCTURE, UNLESS NOTED OTHERWISE.
2. RIM ELEVATIONS ARE APPROXIMATE. CONTRACTOR TO SET RIM AT 1/2 INCH BELOW FINISHED GRADE.
3. STRUCTURE OFFSETS ARE APPROXIMATE. CONTRACTOR TO STAKE THE TOE OF PROPOSED BARRIERS PRIOR TO INSTALLING DRAINAGE STRUCTURES AND INSTALL STRUCTURES AS CLOSE TO THE BARRIER AS POSSIBLE. SEE DETAIL SHEET DD08.
4. ALL GRATES AND COVERS SHALL BE BOLTED DOWN WITH A 5/8"-NCx2" ALLEN HEAD STAINLESS STEEL CAP SCREW UNLESS OTHERWISE NOTED.

**ATKINSON**  
JUN 15 2017  
RELEASED FOR CONSTRUCTION  
P.S.A.

**SCALE:**  
H: 1"=100'  
V: 1"=10'  
  
(NAVD) 88

FILE NAME c:\pwworking\lail_x_ejackson\ld0321992\c8811_PR_DP16.dgn										REGION NO. STATE		FED.AID PROJ.NO.			DATE 6/16/17	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	 Washington State Department of Transportation	I-405/SR167 INTERCHANGE DIRECT CONNECTOR		PLAN REF. NO. DP16				
TIME 10:31:02 AM					10	WASH																					
DATE 6/9/2017																											OF
PLOTTED BY EJackson																											
DESIGNED BY J. TURCOTT																											
ENTERED BY E. JACKSON	REV. 0 - RFC		6/16/17																								
CHECKED BY J. ZIGWEID	REV. B - FINAL REVIEW		4/14/17																								
PROJ. ENGR. C. CHEN	REV. A - PRELIMINARY REVIEW		1/27/17																								
REGIONAL ADM. L. ENG	REVISION		DATE	BY																							SHEETS







MEDIA FILTER DRAIN SPECIFICATION

DESCRIPTION

SECTION 7-01.1 IS SUPPLEMENTED WITH THE FOLLOWING:

THIS WORK SHALL CONSIST OF CONSTRUCTING MEDIA FILTER DRAINS AND PLACING COMPOST.

REFER TO SHEET DD05 FOR TYPICAL MEDIA FILTER DRAIN CONFIGURATIONS.

MATERIALS

SECTION 7-01.2 IS SUPPLEMENTED WITH THE FOLLOWING:

MEDIUM COMPOST 9-14.4(8)  
GEOTEXTILE FOR UNDERGROUND DRAINAGE 9-33

MEDIA FILTER DRAIN

MEDIA FILTER DRAIN MIX

MEDIA FILTER DRAIN MIX SHALL BE MIXED IN THE FOLLOWING PROPORTIONS: 3 CUBIC YARDS OF AGGREGATE, 1 CUBIC YARD OF HORTICULTURAL GRADE PERLITE, 40 POUNDS OF AGRICULTURAL GRADE DOLOMITE, AND 12 POUNDS OF AGRICULTURAL GRADE GYPSUM. MEDIA FILTER DRAIN MIX SHALL BE PREMIXED PRIOR TO PLACEMENT. THE SOIL AMENDMENTS AND AGGREGATE SHALL MEET THE FOLLOWING REQUIREMENTS PRIOR TO MIXING:

AGGREGATE FOR MEDIA FILTER DRAIN MIX

AGGREGATE FOR MEDIA FILTER DRAIN MIX SHALL MEET ALL REQUIREMENTS FOR SECTION 9-03.4 AGGREGATE FOR BITUMINOUS SURFACE TREATMENT - CRUSHED SCREENINGS 3/8-INCH TO NO. 4 EXCEPT THE FRACTURE REQUIREMENT SHALL BE AT LEAST TWO FRACTURED FACES AND WILL APPLY TO MATERIAL RETAINED ON THE U.S. NO. 4 SIEVE IN ACCORDANCE WITH FOP FOR AASHTO T 335.

HORTICULTURAL GRADE PERLITE

HORTICULTURAL GRADE PERLITE SHALL BE PER SECTION 9-14.4(9), MEET THE FOLLOWING GRADING REQUIREMENTS, AND NOT CONTAIN ANY TOXIC MATERIAL:

SIEVE SIZE	% PASSING
NO. 4	99% - 100%
NO. 18	0% - 30%
NO. 30	0% - 10%

AGRICULTURAL GRADE DOLOMITE

AGRICULTURAL GRADE DOLOMITE SHALL BE PER SECTION 9-14.4(5) AND MEET THE REQUIREMENTS OF ASTM C 602 CLASS DESIGNATION E.

AGRICULTURAL GRADE GYPSUM

AGRICULTURAL GRADE GYPSUM SHALL BE PER SECTION 9-14.4(6) AND MEET THE FOLLOWING GRADING REQUIREMENTS:

SIEVE SIZE	% PASSING
1/4-INCH	99% - 100%
NO. 20	0% - 20%

THE ACCEPTANCE OF THE AGGREGATE SHALL BE BASED ON A SATISFACTORY TEST REPORT FOR EVERY 1000 TONS. TESTING OF AGGREGATE SHALL OCCUR PRIOR TO MIXING WITH THE SOIL AMENDMENTS. HORTICULTURAL GRADE PERLITE, AGRICULTURAL GRADE DOLOMITE AND GYPSUM WILL BE ACCEPTED BY CATALOG CUT OR BAG LABEL.

THE FINISHED PRODUCT SHALL BE CLEAN, UNIFORMLY MIXED, AND FREE FROM WOOD, BARK, ROOTS, AND OTHER DELETERIOUS MATERIALS.

STRUCTURAL SOIL MIX

THE STRUCTURAL SOIL MIX FOR THE GRASS STRIP SHALL CONSIST OF A UNIFORM BLEND COMPOSED BY VOLUME OF 70% TO 80% AGGREGATE, 20% TO 30% COMPOST. 100% OF THE MIXTURE SHALL PASS THROUGH A 2-1/2 INCH SIEVE.

COMPOST

COMPOST SHALL BE MEDIUM COMPOST AND MEET THE MATERIAL REQUIREMENTS AS SPECIFIED IN SECTION 9-14.4(8).

AGGREGATE

AGGREGATE SHALL CONSIST OF BALLAST IN ACCORDANCE WITH SECTION 9-03.9(1).

MIXING REQUIREMENTS

THE CONTRACTOR SHALL SUBMIT THE PROPOSED METHOD OF MIXING IN WRITING FOR THE ENGINEER'S APPROVAL. NO MIXING SHALL TAKE PLACE WITHOUT WRITTEN APPROVAL FROM THE ENGINEER.

STRUCTURAL SOIL MIX SHALL BE THOROUGHLY MIXED PRIOR TO BEING PLACED.

CONSTRUCTION REQUIREMENTS

SECTION 7-01.3 IS SUPPLEMENTED WITH THE FOLLOWING:

MEDIA FILTER DRAIN

THE CONTRACTOR SHALL CONSTRUCT THE MEDIA FILTER DRAIN IN ACCORDANCE WITH THE DETAILS IN THE PLANS.

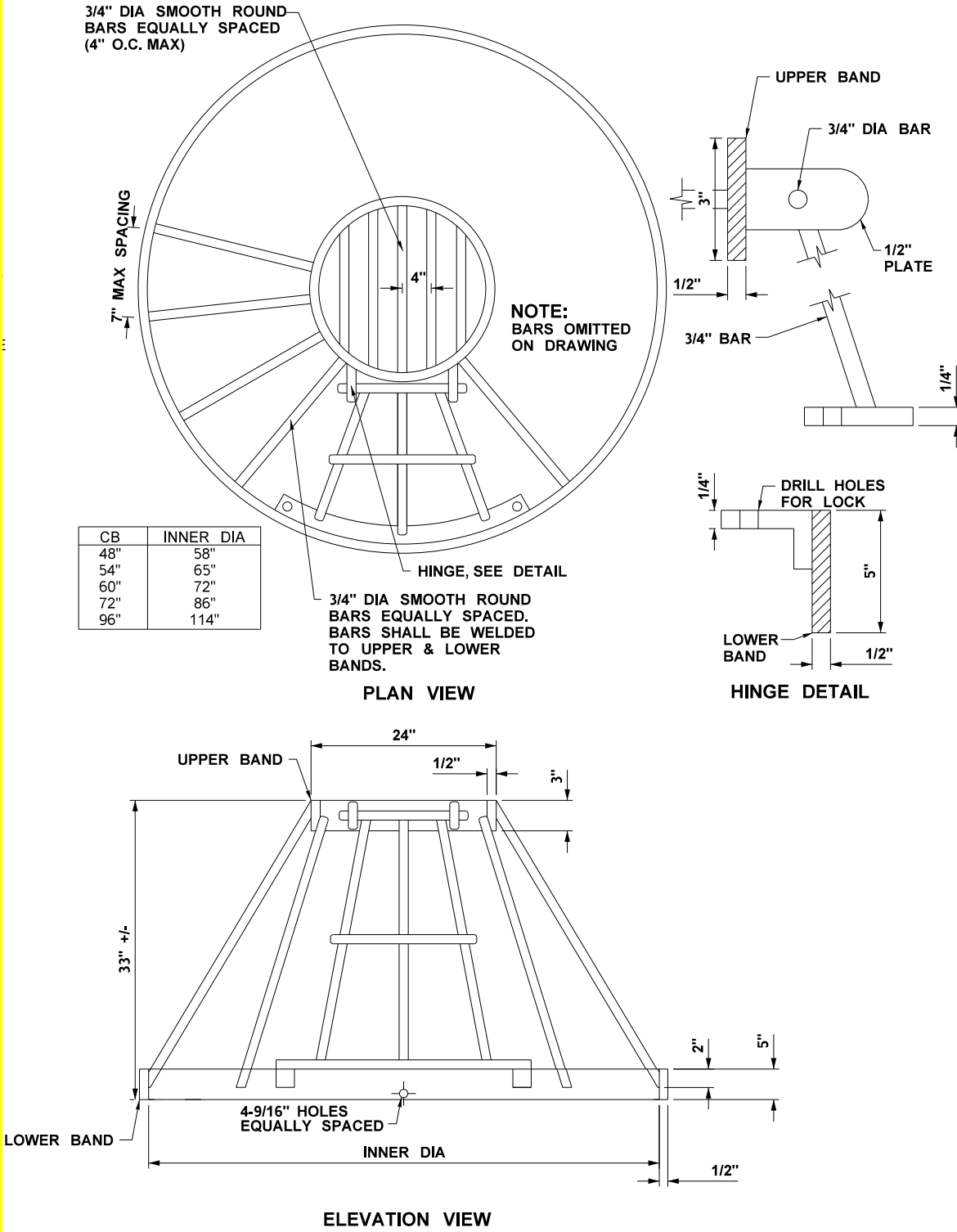
THE CONTRACTOR SHALL CONDUCT THE INSTALLATION OF THE MEDIA FILTER DRAIN SUCH THAT THE DIFFERENT SECTIONS OF THE MEDIA FILTER DRAIN ARE NOT CONTAMINATED OR DISPLACED BY OTHER MATERIALS DURING INSTALLATION.

THE CONTRACTOR SHALL NOT SEED, FERTILIZE OR MULCH THE MEDIA FILTER DRAIN MIX

ONCE INSTALLED, THE CONTRACTOR WILL NOT BE ALLOWED TO DRIVE EQUIPMENT OVER THE AREA OF THE MEDIA FILTER DRAIN.

MEDIA FILTER DRAIN EXCAVATION SHALL CONFORM TO SECTION 2-09.3(4). EXCAVATED MATERIAL SUITABLE FOR USE IN EMBANKMENT MAY BE USED AT THE DISCRETION OF THE ENGINEER. OTHERWISE, THE MATERIAL EXCAVATED SHALL BECOME PROPERTY OF THE CONTRACTOR.

THE CONTRACTOR SHALL PLACE THE STRUCTURAL SOIL MIX IN LAYERS NO MORE THAN 5-INCHES IN DEPTH BEFORE COMPACTION. EACH LAYER SHALL BE COMPACTED BY THREE PASSES OF A VIBRATORY PLATE COMPACTOR. AFTER PLACEMENT AND COMPACTION OF STRUCTURAL SOIL MIX, MEDIUM COMPOST SHALL BE PLACED TO A DEPTH OF TWO INCHES PRIOR TO SEEDING, FERTILIZING AND MULCHING.



NOTE:  
ALL PARTS MUST BE EITHER ALUMINUM OR STAINLESS STEEL. NO GALVANIZED MATERIAL TO BE USED.

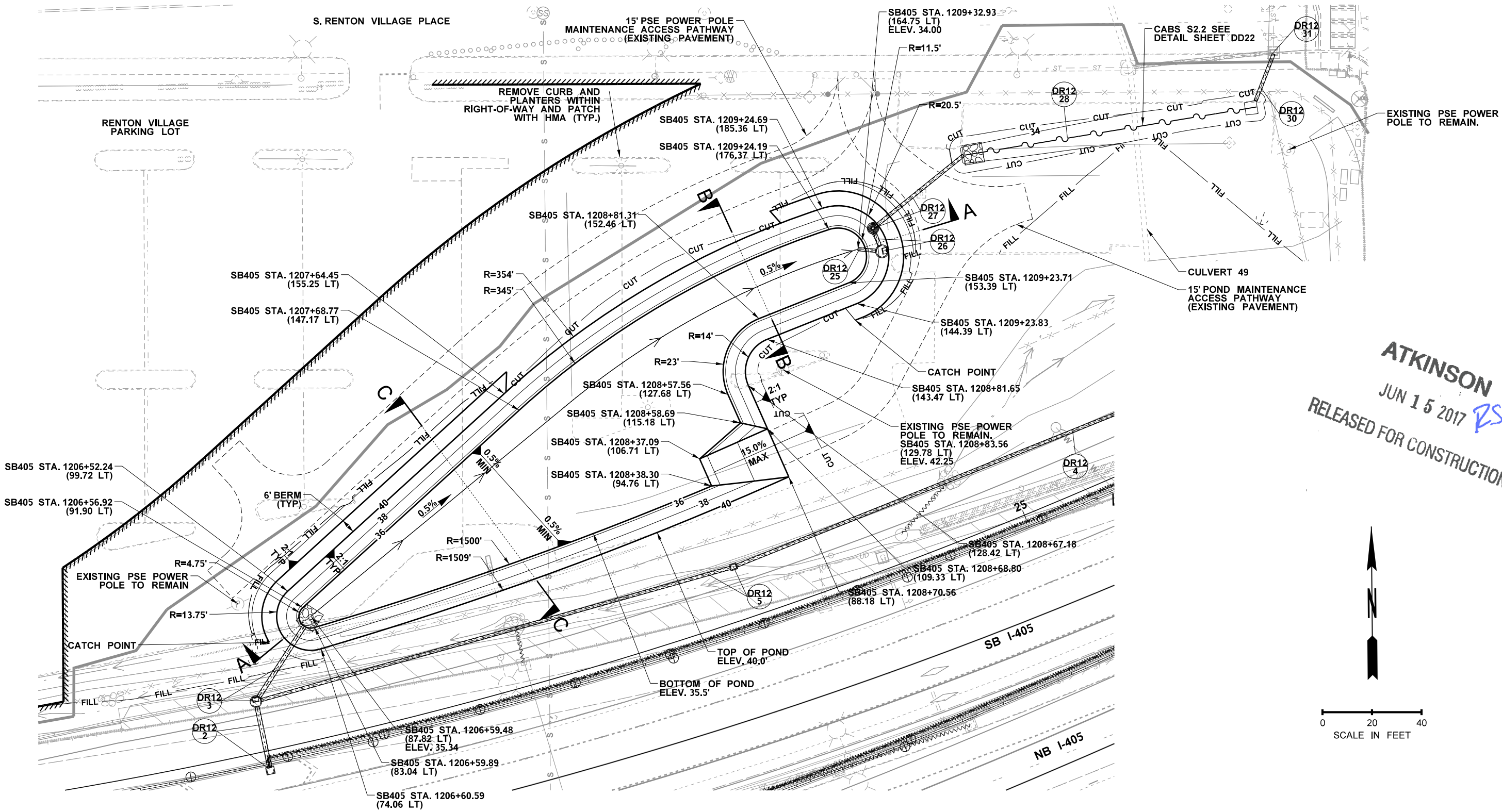
DEBRIS CAGE  
N.T.S.

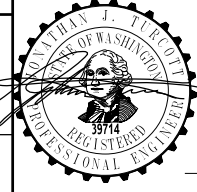
ATKINSON  
JUN 15 2017  
RELEASED FOR CONSTRUCTION

FILE NAME	c:\pwworking\atkins\jackson\dd06.dgn	REGION NO.	10	STATE	WASH	FED.AID PROJ.NO.			DATE	DATE		I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR	PLAN REF NO
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DATE	6/8/2017												SHEET
PLOTTED BY	EJackson												OF
DESIGNED BY	J. TURCOTT	REV. 0 - RFC	6/16/17										SHEETS
ENTERED BY	E. JACKSON	REV. B - FINAL REVIEW	4/14/17										
CHECKED BY	J. ZIGWEID	REV. A - PRELIMINARY REVIEW	01/27/17										
PROJ. ENGR.	C. CHEN												
REGIONAL ADM.	L. ENG	REVISION	DATE	BY		C8811							

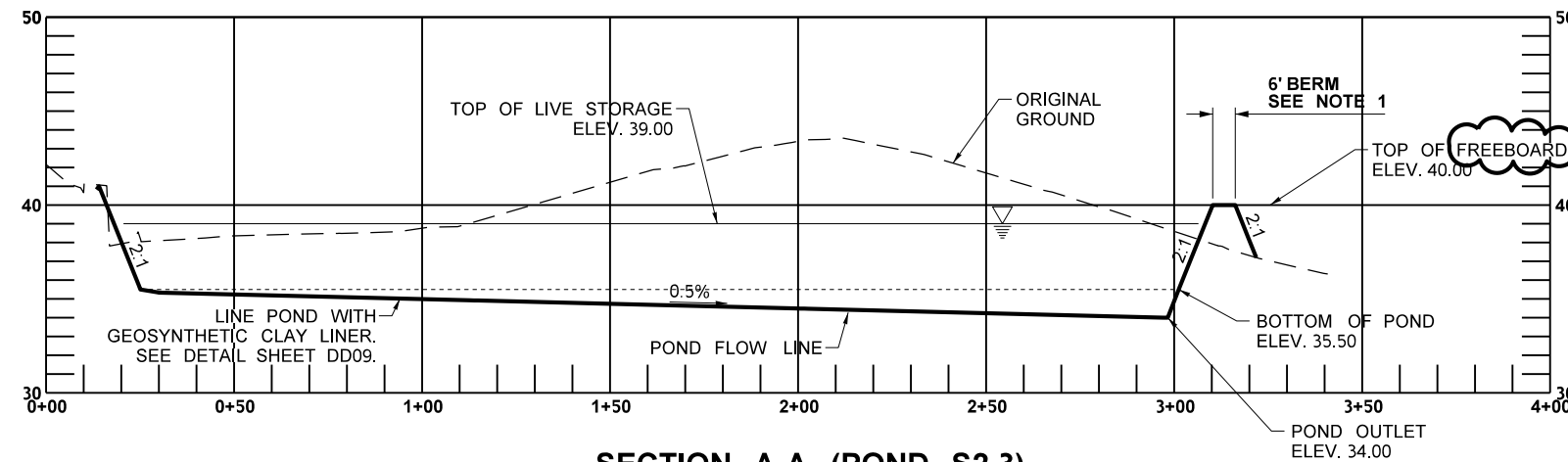


SEC.19 T.23N. R.5E. W.M.



FILE NAME c:\pwworking\atl_x_jzigweid\0321992\08811_DE_DD11A.dgn										REGION NO. STATE		FED.AID PROJ.NO.				DATE 6/16/17		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE	
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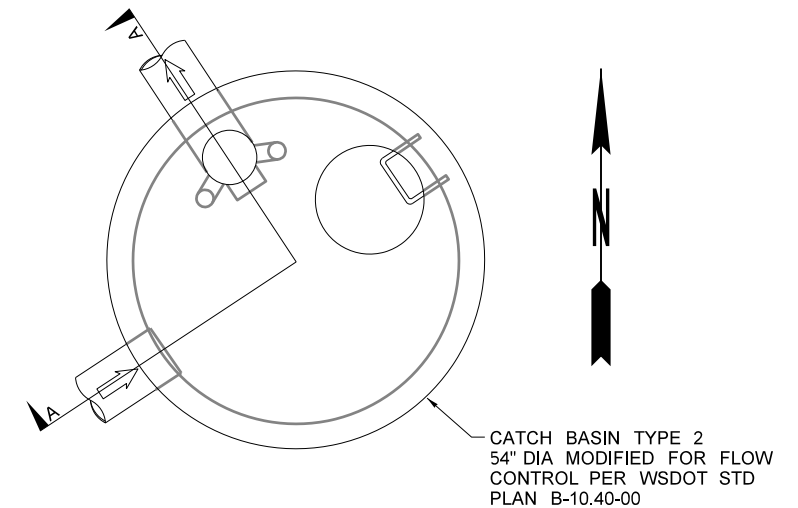




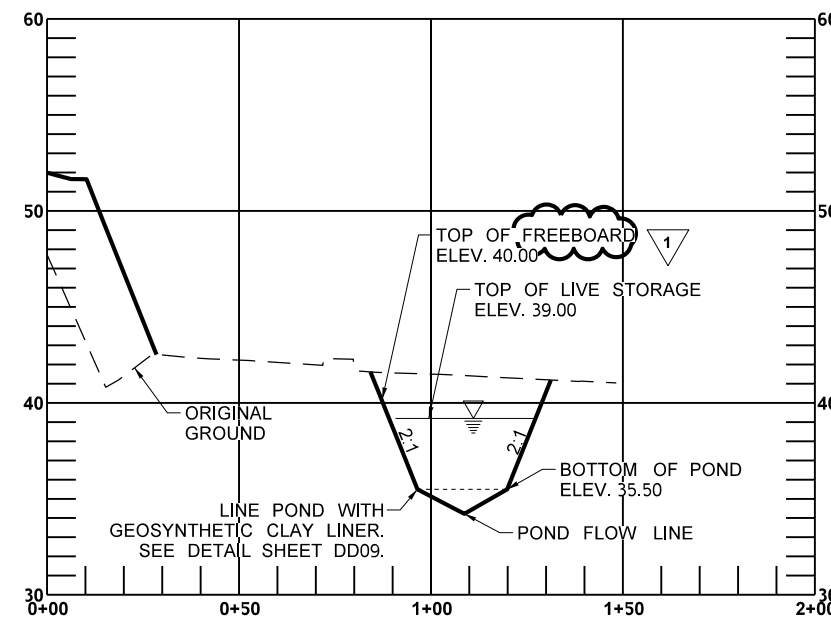
**SECTION A-A (POND S2.3)**  
HORIZ: 1"=50'  
VERT: 1"=10'

**POND BERM NOTE:**

1. THE BERM SHALL BE CONSTRUCTED IN ACCORDANCE WITH SECTION 9.2.2 OF THE WSDOT GDM AND SECTIONS 2.2.2 AND 2.3.7 OF THE WASHINGTON STATE DEPARTMENT OF ECOLOGY DAM SAFETY OFFICE (DSO) DAM SAFETY GUIDELINES. POND BERM FILL WILL CONSIST OF EMBANKMENT MATERIAL AS SPECIFIED IN SECTION 5-4.1.4 OF THE 2014 HIGHWAY RUNOFF MANUAL (A MIN. OF 30 PERCENT CLAY, A MAX. OF 60 PERCENT SAND, A MAX. OF 60 PERCENT SILT AND NEGLIGIBLE GRAVEL AND COBBLE) AND COMPACTED PER SECTION 2-03.3(14)C METHOD C.

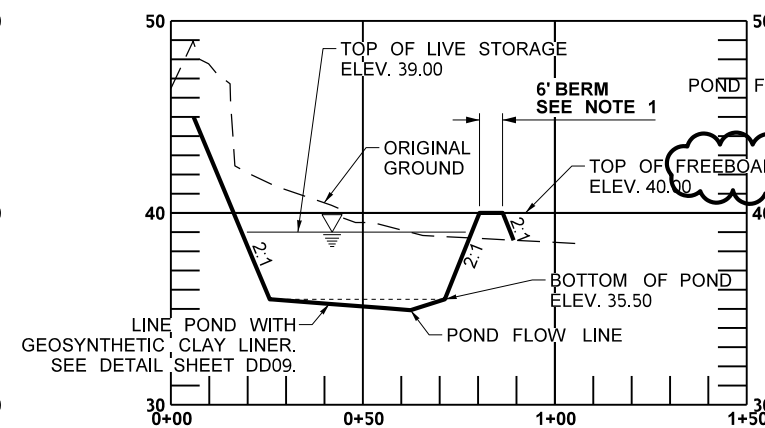


DR12-26 PLAN VIEW

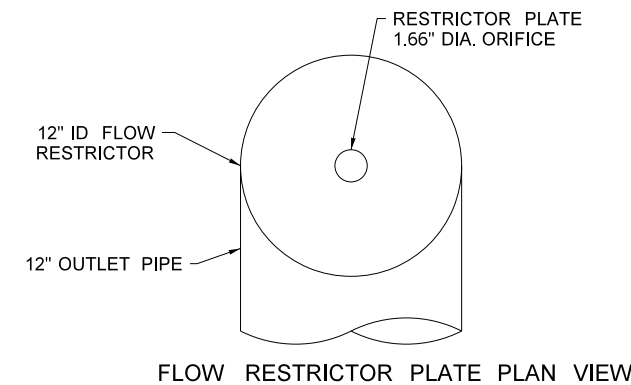


**SECTION B-B (POND S2.3)**  
HORIZ: 1"=50'  
VERT: 1"=10'

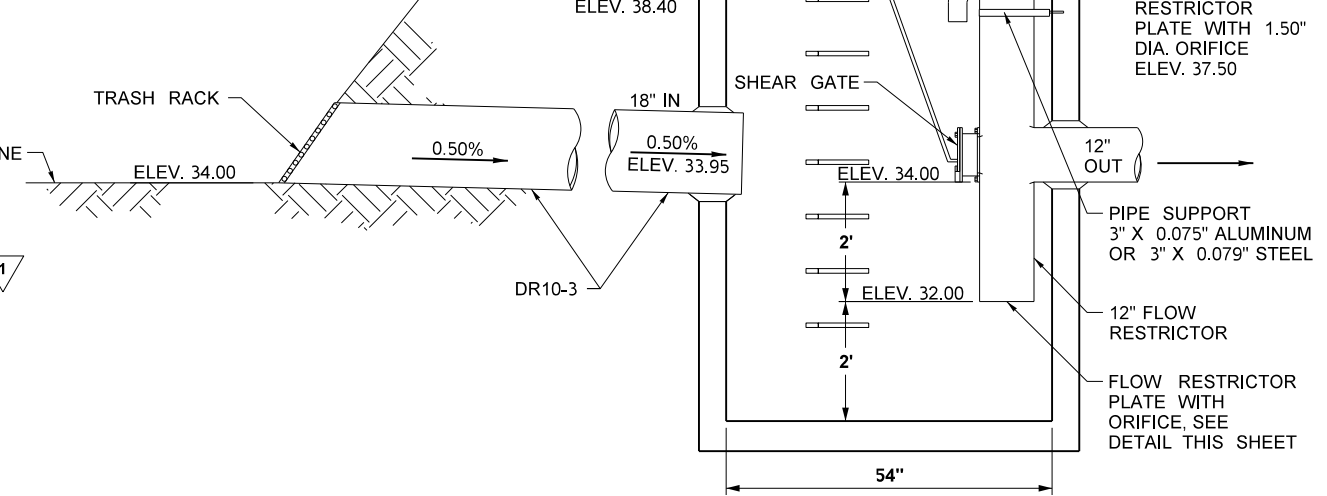
**ATKINSON**  
JUL 11 2018 *PSA*  
RELEASED FOR CONSTRUCTION



**SECTION C-C (POND S2.3)**  
HORIZ: 1"=50'  
VERT: 1"=10'





FLOW RESTRICTOR PLATE PLAN VIEW

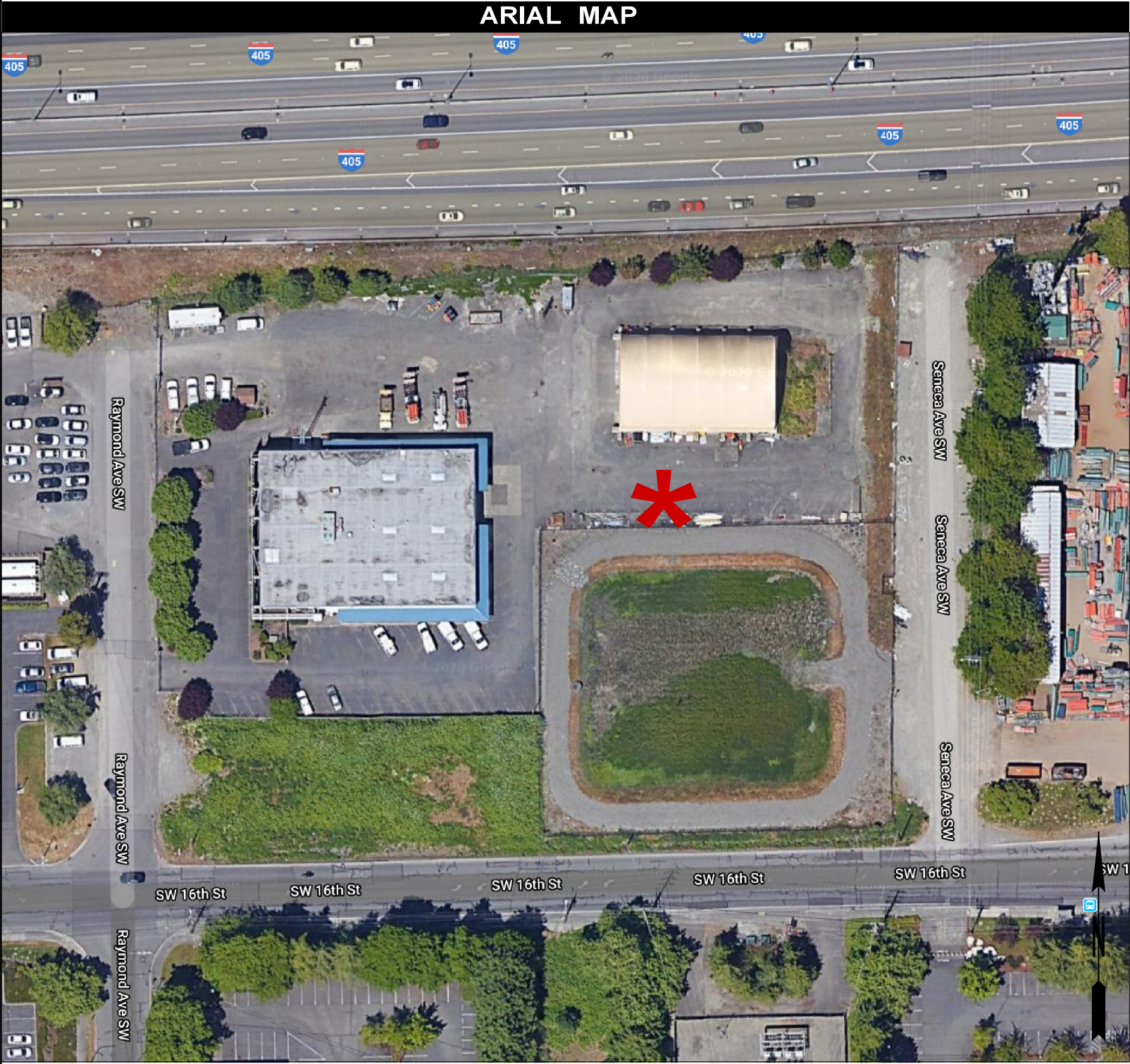


DR12-26 SECTION A-A

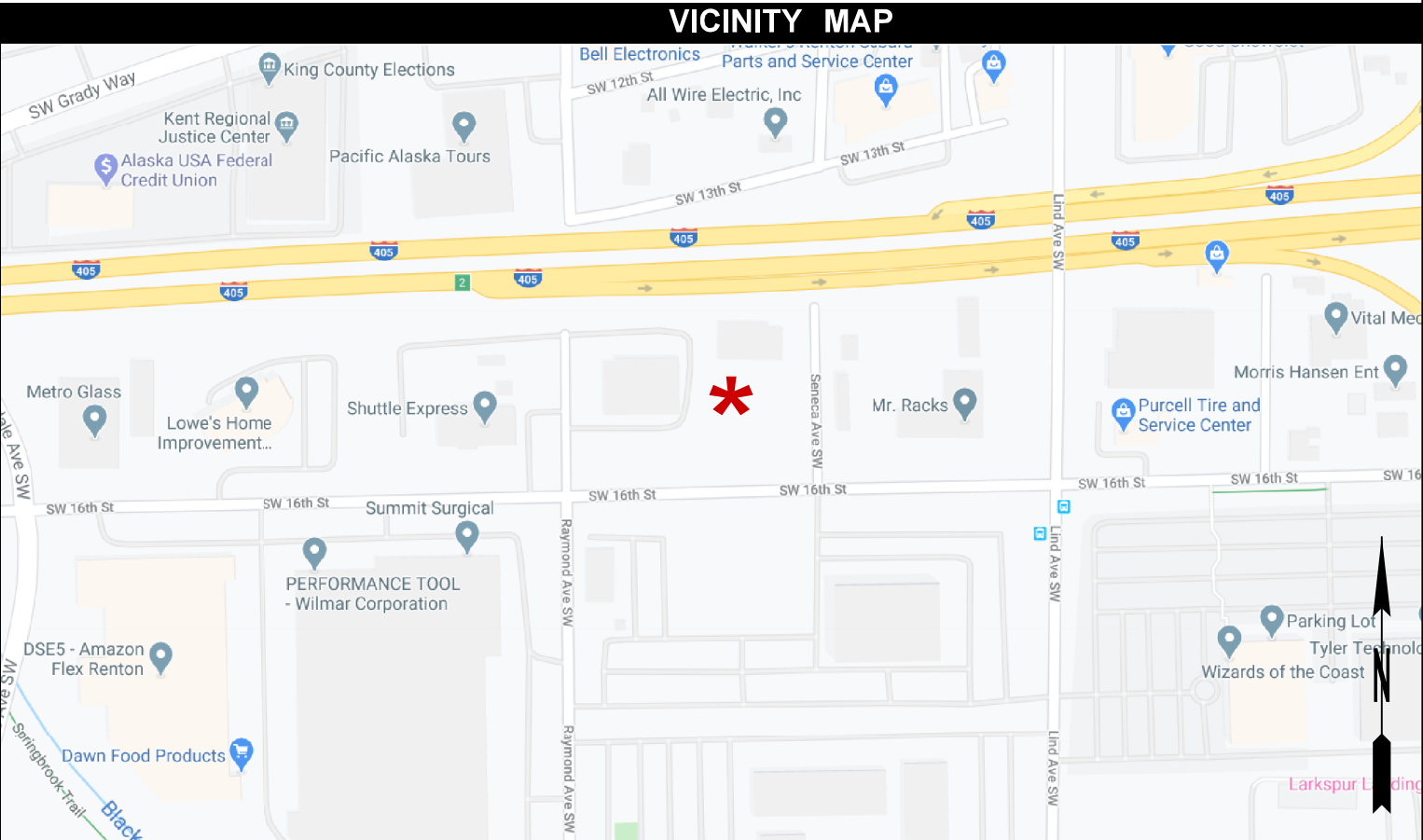
**CONTROL STRUCTURE DETAIL**  
N.T.S.

FILE NAME c:\pwworking\atl_x_smesc\0321992\C8811_DE_DD11B.dgn			REGION NO. STATE		FED.AID PROJ.NO.		DATE	DATE	 Washington State Department of Transportation	I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR	POND S2.3 SECTIONS AND DETAILS	PLAN REF NO
TIME 3:02:00 PM			10	WASH								DD11B
DATE 7/9/2018												SHEET
PLOTTED BY SMesic												OF
DESIGNED BY J. TURCOTT	REV. 1 - RFI0293	7/9/18										SHEETS
ENTERED BY E. JACKSON	REV. 0 - RFC	6/16/17										
CHECKED BY J. ZIGWEID	REV. B - FINAL REVIEW	4/14/17										
PROJ. ENGR. C. CHEN	REV. A - PRELIMINARY REVIEW	1/27/17										
REGIONAL ADM. L. ENG	REVISION	DATE	BY	C8811	LOCATION NO.							





SITE INFORMATION	
LOCATION:	I-405 MP 1.9
FACILITY TYPE:	COMPOST-AMENDED BIOFILTRATION SWALE
MAINTENANCE RESPONSIBILITY:	WSDOT
DESIGN:	OL-XXXX   CONSTRUCTION: 01XXXX   JOB NUMBER: XXXX
HYDRAULIC REPORT	TBD
MODIFIED BY:	N/A
SITE DESCRIPTION:	THIS IS A 100 LF FACILITY PROVIDING ENHANCED WATER QUALITY TREATMENT.
AS-BUILT FIELD VERIFICATION:	N/A
SURVEY BENCH MARK:	TBD
FEATURE ANOMALIES:	N/A
DISCLAIMER:	NOTIFY MAINTENANCE SUPERVISOR IF THE BMP IS NOT CHARACTERISTIC OF THIS OWNER'S MANUAL TO FACILITATE MAINTENANCE ACTIVITIES. CONTACT MAINTENANCE SUPERINTENDENT BEFORE ANY MAINTENANCE TAKES PLACE. IF SENSITIVE AREAS OR BUFFERS ARE ADJACENT TO FENCE LINE, CONTACT NW REGION ENVIRONMENTAL PROGRAM MANAGER OR MAINTENANCE AREA BMP LEAD TECH PRIOR TO STARTING OF WORK.
DIRECTIONS:	



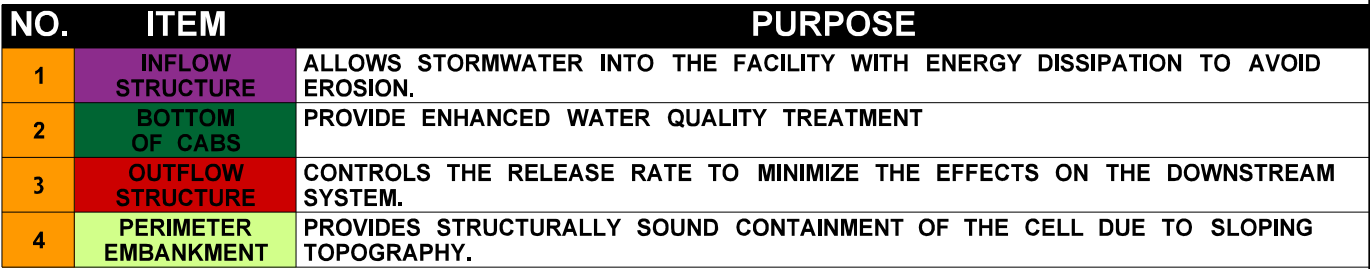




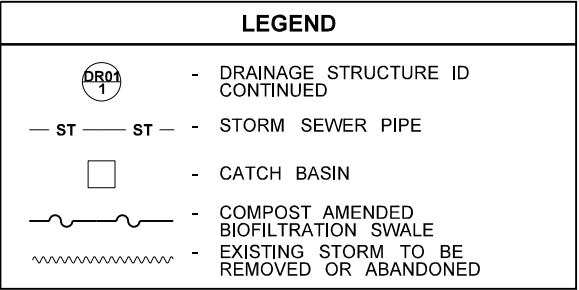
FEATURE #: WSDOT####

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SHEET 2 OF 7



NO.	ITEM	BMP MAINTENANCE ACTIVITY
NOTE: THE FOLLOWING ITEMS SUPPLEMENT HRM TABLES 5-12 THROUGH 5-24. REFER TO TABLES 5-12 THROUGH 5-24 FOR GENERAL MAINTENANCE ACTIVITIES.		
1	INFLOW STRUCTURE	REFER TO HRM TABLES 5-12 THROUGH 5-24.
2	BOTTOM OF CABS	REFER TO HRM TABLES 5-12 THROUGH 5-24.
3	OUTFLOW STRUCTURE	REFER TO HRM TABLES 5-12 THROUGH 5-24.
4	PERIMETER EMBANKMENT	SEED EXPOSED SOILS WITH NATIVE SEED MIX OR COVER WITH WOOD MULCH.





SEC.19 T.23N. R.5E. W.M.



0 50 100  
SCALE IN FEET



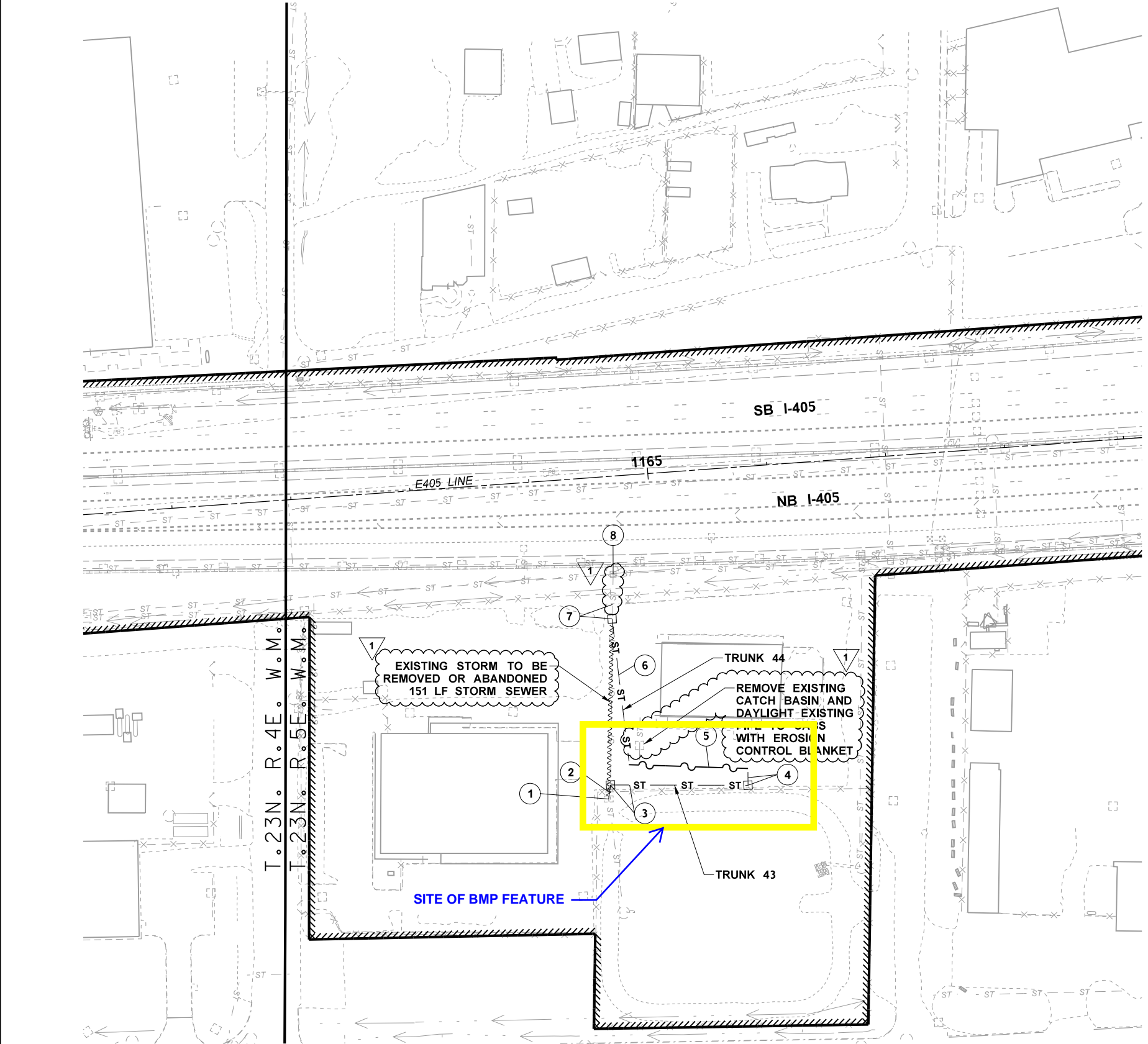
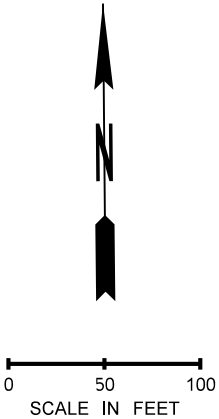




SEC.19 T.23N. R.5E. W.M.

DRAINAGE REFERENCE SUMMARY	
DESCRIPTION	PROFILE/DETAIL SHEET(S)
TRUNK 43	DP23
TRUNK 44	DP23
CABS S2.1	DD21

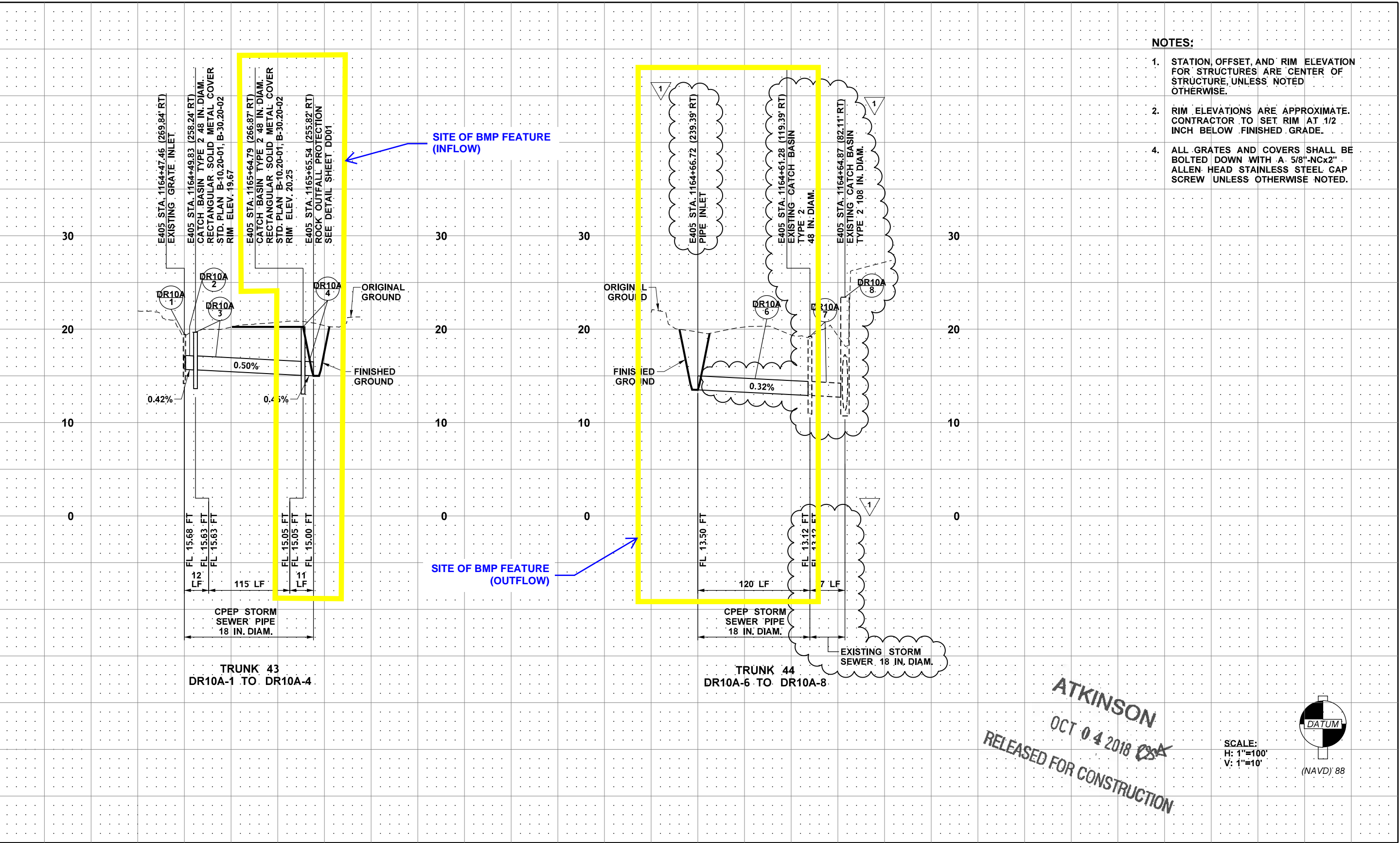
ATKINSON  
OCT 04 2018  
RELEASED FOR CONSTRUCTION

LEGEND	
①	- DRAINAGE STRUCTURE ID
DR01 1	- DRAINAGE STRUCTURE ID CONTINUED
— ST — ST —	- STORM SEWER PIPE
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□	- CATCH BASIN
▣	- GRATE INLET
▤	- DROP INLET
○	- MANHOLE
■	- ROCK OUTFALL PROTECTION
→	- DRAINAGE DITCH
~	- COMPOST AMENDED BIOFILTRATION SWALE
▨	- MEDIA FILTER DRAIN
~~~~~	- EXISTING STORM TO BE REMOVED OR ABANDONED



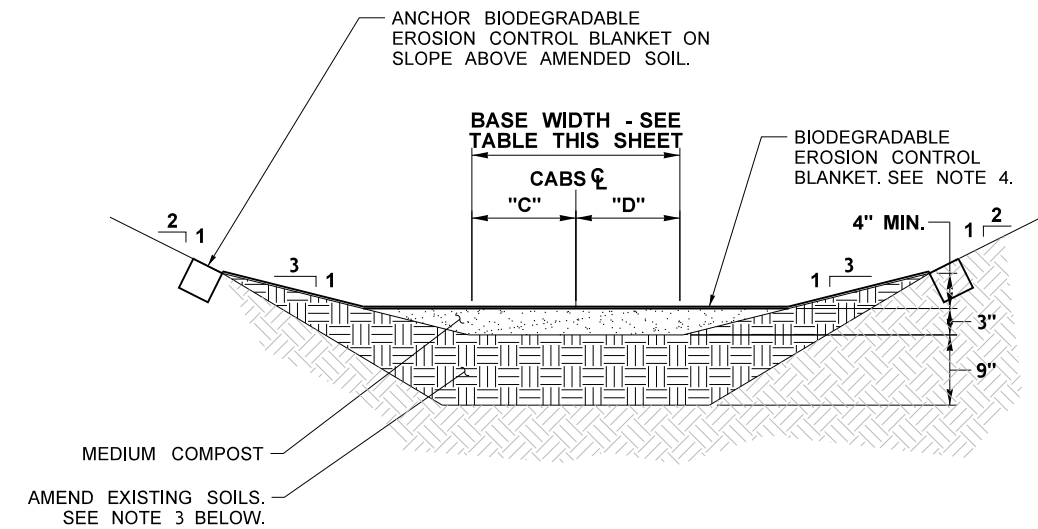
FILE NAME c:\pwworking\nai\ x_grimando\0321992\C8811_PS_DR10A.dgn										REGION NO. STATE 10 WASH		FED.AID PROJ.NO.			 Washington State Department of Transportation		I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR		PLAN REF NO DR10A	
TIME 2:51:12 PM																			SHEET	
DATE 10/3/2018												OF								
PLOTTED BY GRimando												SHEETS								
DESIGNED BY J. TURCOTT																				
ENTERED BY E. JACKSON		REV. 1 - RFI 0320		10/03/18																
CHECKED BY J. ZIGWEID		REV. 0 - RFC		6/16/17																
PROJ. ENGR. C. CHEN		REV. A - FINAL REVIEW		4/14/17																
REGIONAL ADM. L. ENG		REVISION		DATE		BY		C8811												





FILE NAME										c:\pwworking\lail_x_grimando\d0321992\IC8811_PR_DP23.dgn																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		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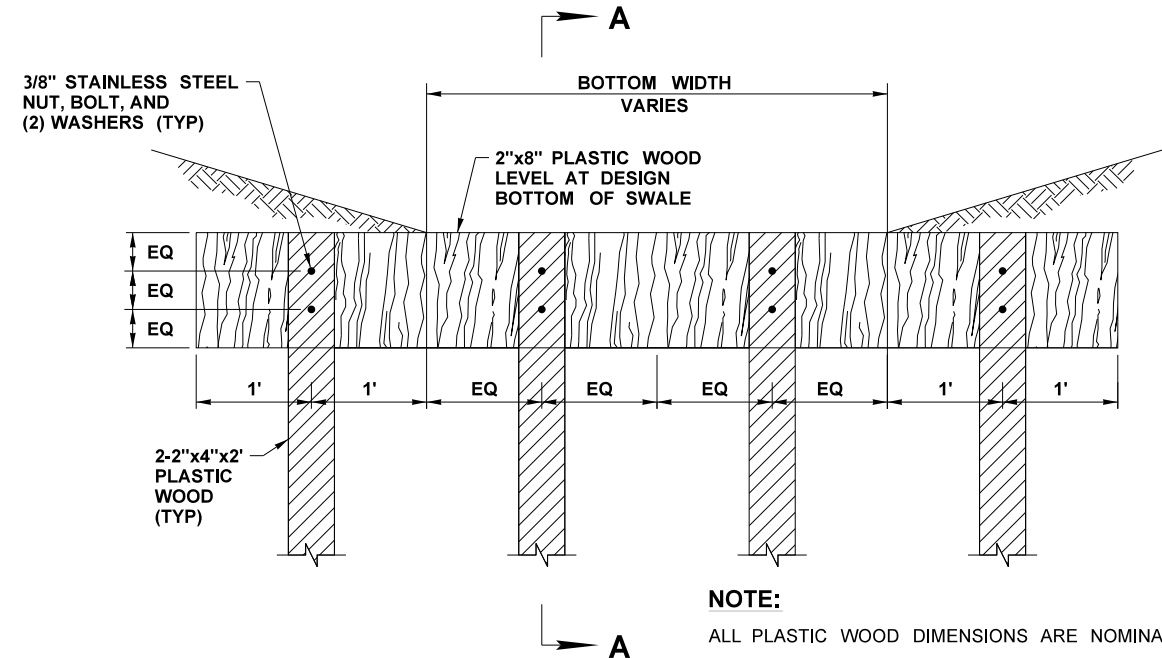


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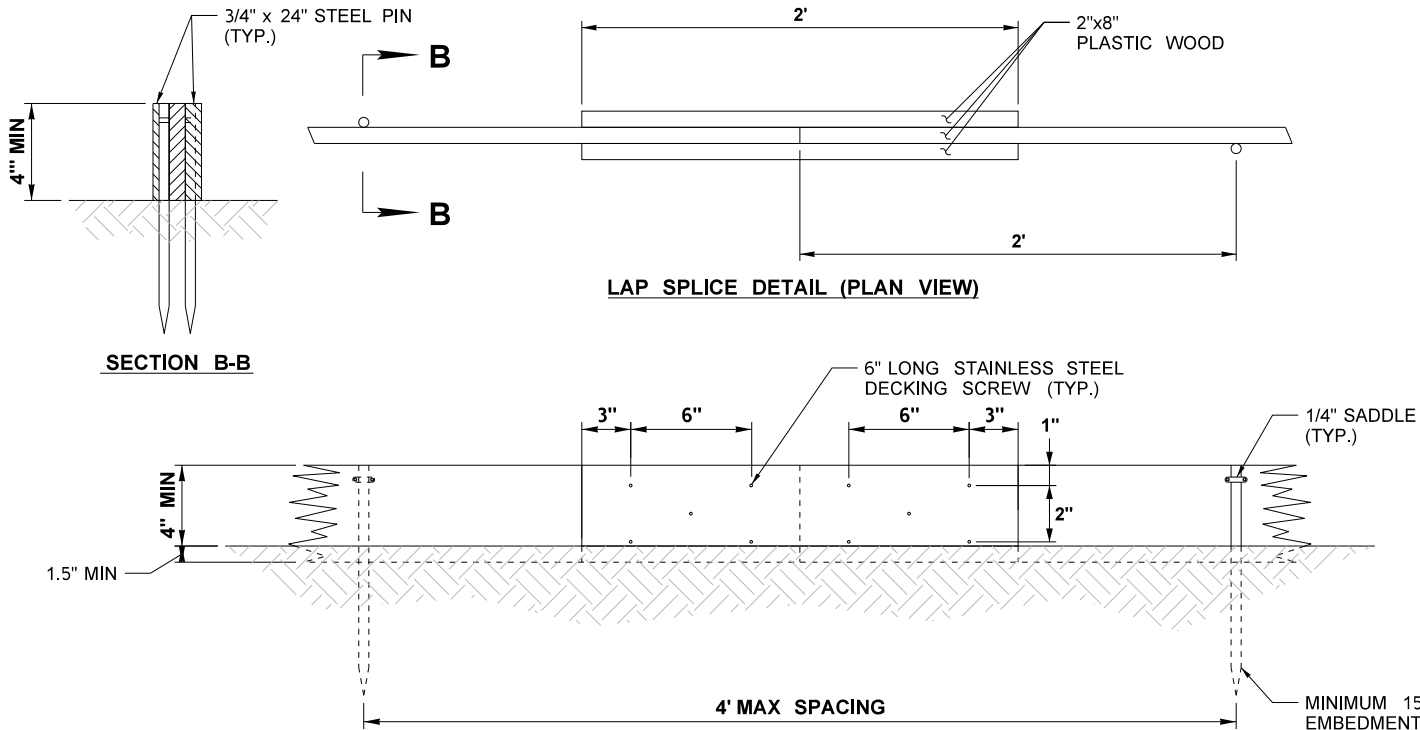
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FLOW SPREADER DETAIL

N.T.S.

COMPOST-AMENDED BIOFILTRATION SWALE LIMITS

ID	BEGIN STA			END STA			BASE WIDTH (FT)	LEFT OFFSET "C" (FT)	RIGHT OFFSET "D" (FT)	FLOW SPREADER (SEE DETAIL THIS SHEET)	DIVIDER (SEE DETAIL THIS SHEET)
DR10A-5	N / E	173358.28	1295976.84	N / E	173362.35	1295876.93	6	3	3		
DR12-28	SB405-SB	25+35.21	143.56' LT	SB405-SB	26+59.19	110.46' LT	5	2.5	2.5		
DR10-7	NB167	349+33.77	75.99' RT	NB167	348+30.28	196.19' RT	15	7.5	7.5	X	X

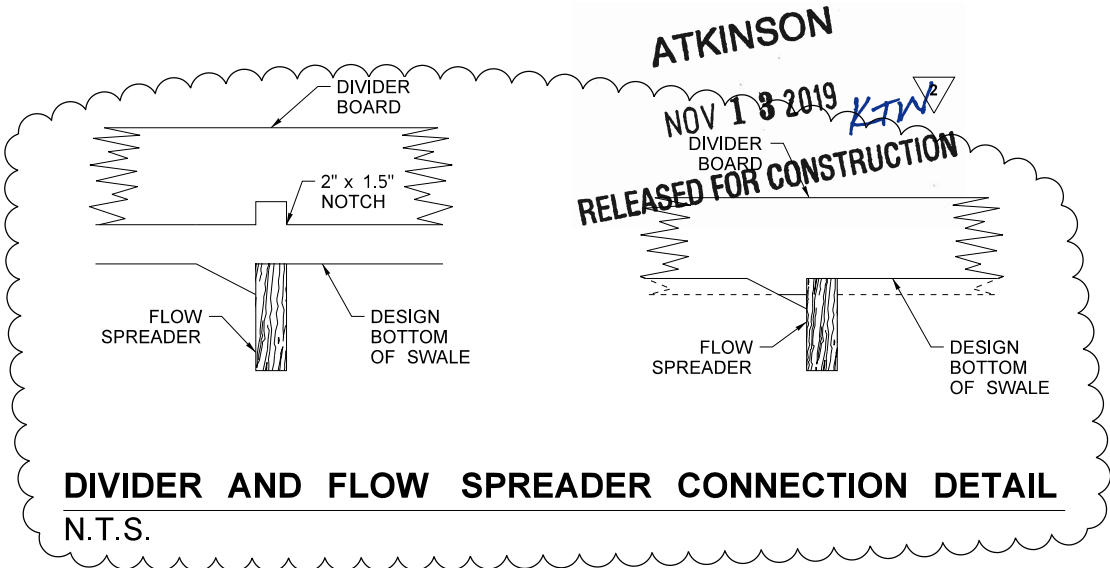


PROFILE NOTE:

ALL PLASTIC WOOD DIMENSIONS ARE NOMINAL.

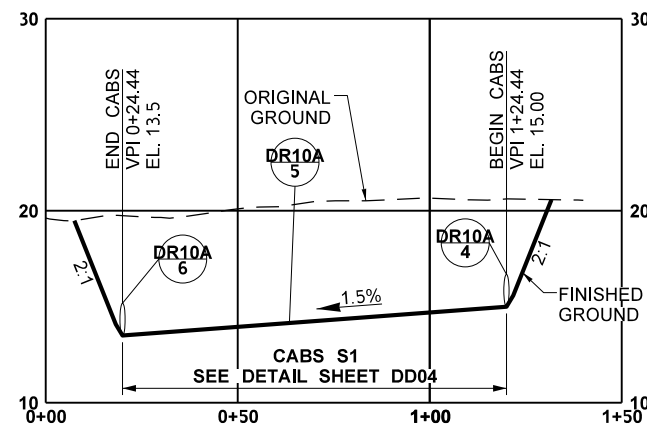
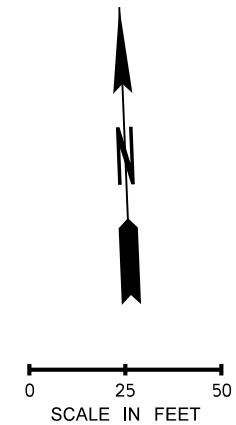
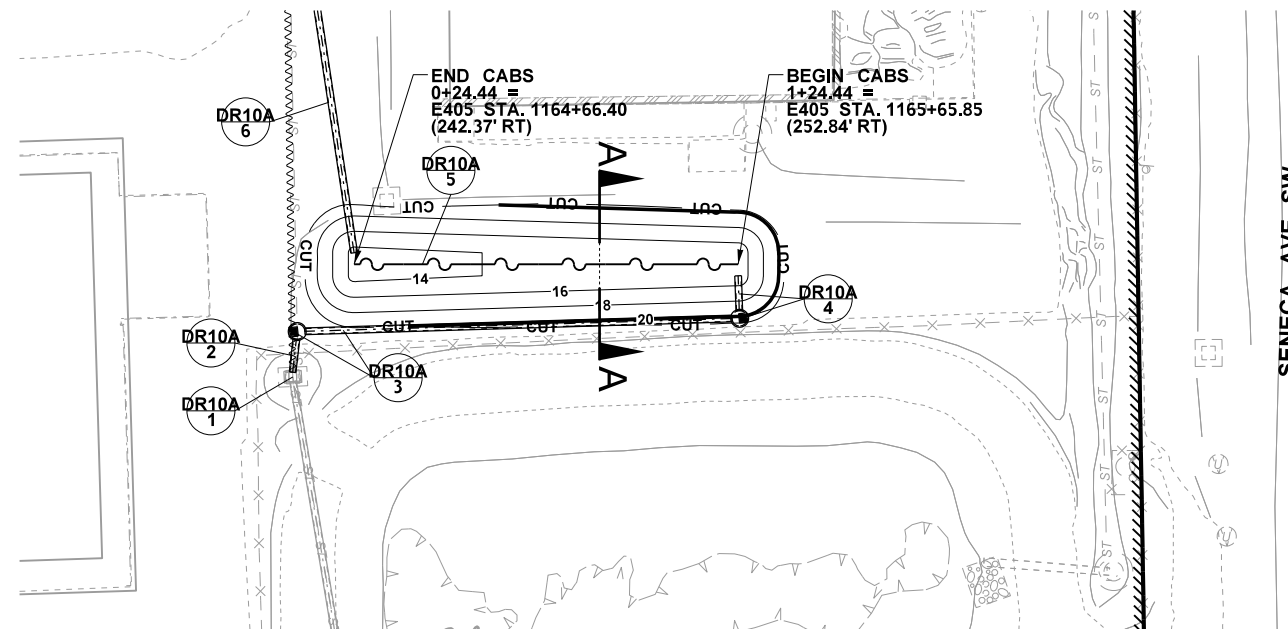
DIVIDER DETAIL

N.T.S.

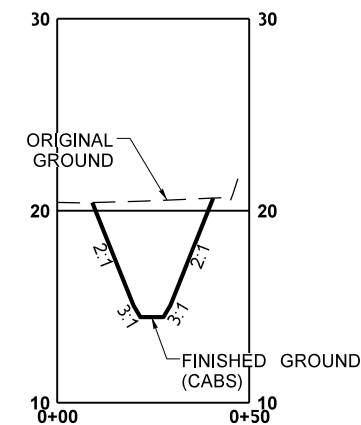


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REV. 2 - RFI 0388		11/11/19		REV. 1 - RFI 0375		08/05/19		REV. 0 - RFC		06/16/17		REV. B - FINAL REVIEW		04/14/17		REV. A - PRELIMINARY REVIEW	
REVISION		DATE		BY		C8811											
REGION NO. 10		STATE WASH		FED.AID PROJ.NO.		JOB NUMBER		CONTRACT NO.		LOCATION NO.		P.E. STAMP BOX		DATE		P.E. STAMP BOX	
Washington State Department of Transportation		I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR		DRAINAGE DETAILS		PLAN REF NO DD04		SHEET OF SHEETS									





**CABS PROFILE (S1)**  
HORIZ: 1"=50'  
VERT: 1"=10'



**CABS SECTION (A-A)**  
HORIZ: 1"=50'  
VERT: 1"=10'

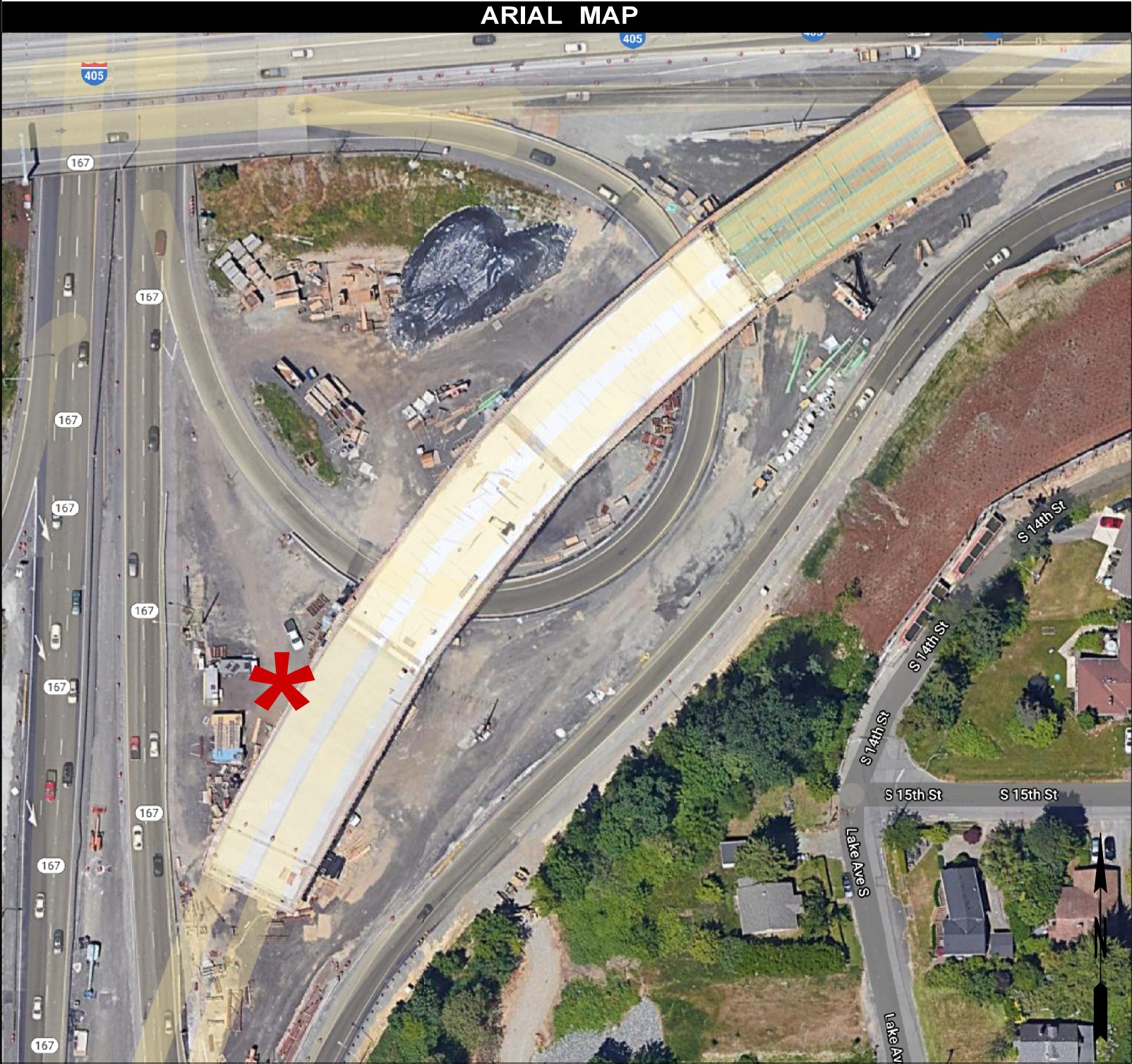


(NAVD) 88

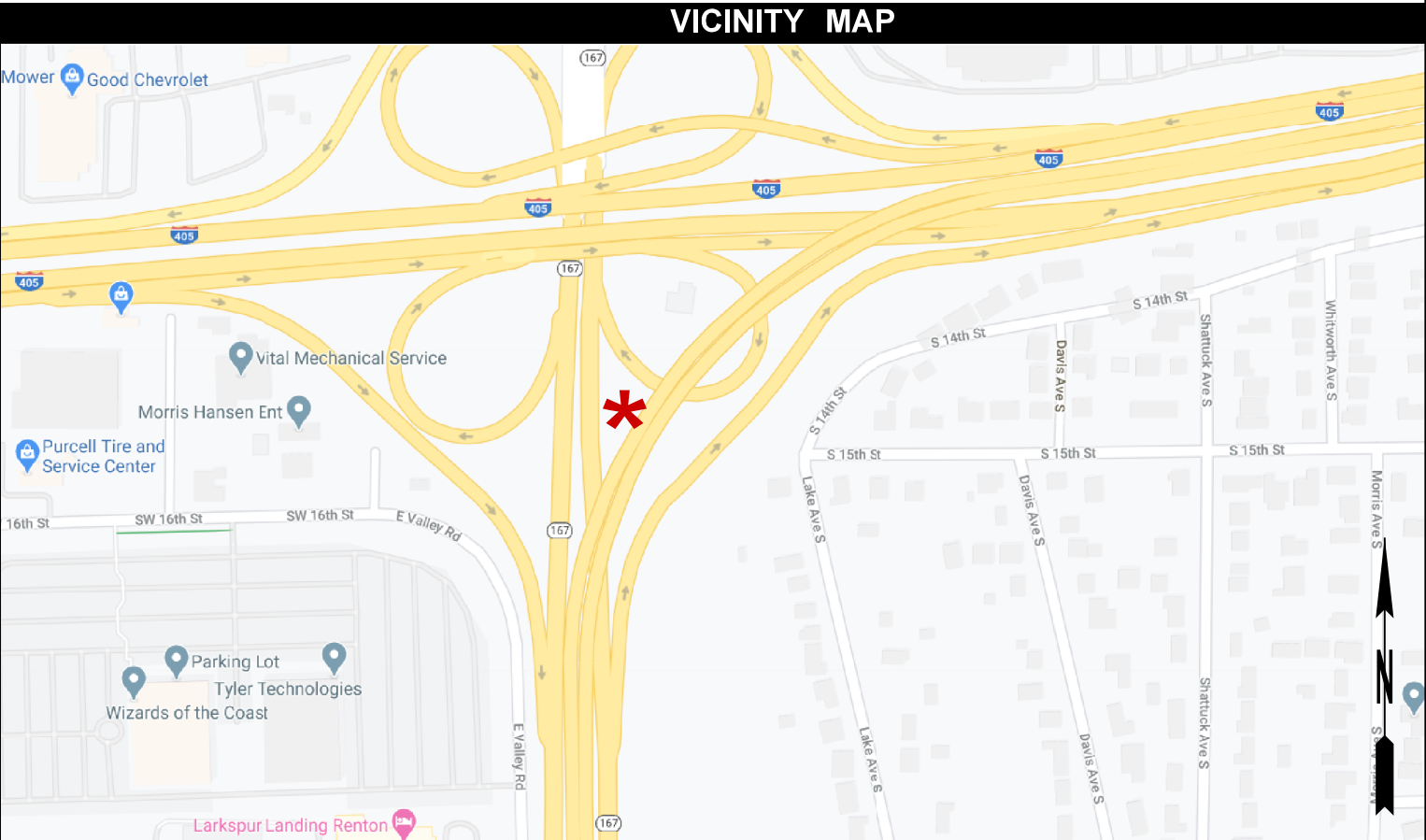
ATKINSON  
JUN 15 2017  
RELEASED FOR CONSTRUCTION

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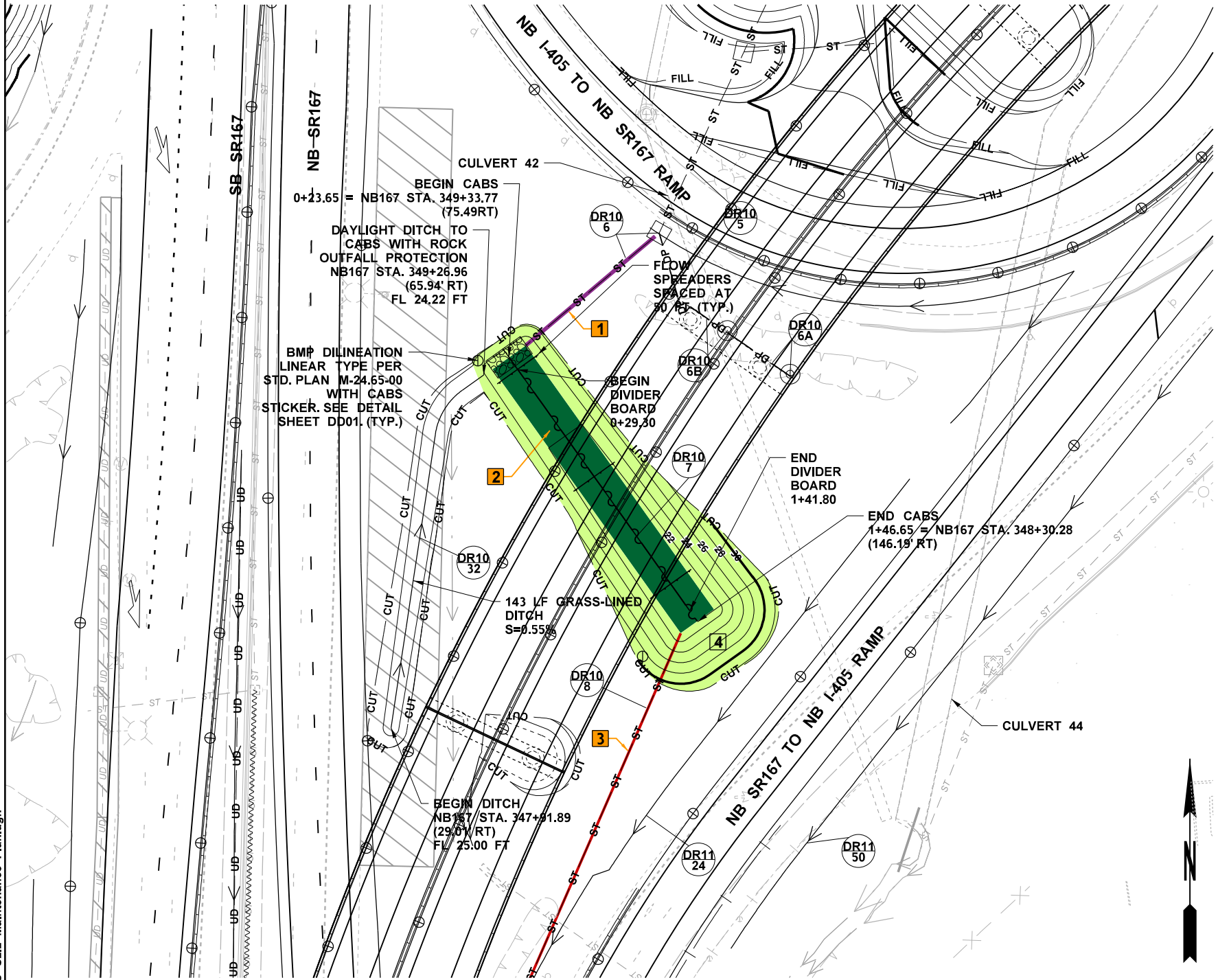




SITE INFORMATION	
LOCATION:	SR 167 26.2
FACILITY TYPE:	COMPOST-AMENDED BIOFILTRATION SWALE
MAINTENANCE RESPONSIBILITY:	WSDOT
DESIGN:	OL-XXXX   CONSTRUCTION: 01XXXX   JOB NUMBER: XXXX
HYDRAULIC REPORT	TBD
MODIFIED BY:	N/A
SITE DESCRIPTION:	THIS IS A 123 LF FACILITY PROVIDING ENHANCED WATER QUALITY TREATMENT.
AS-BUILT FIELD VERIFICATION:	N/A
SURVEY BENCH MARK:	TBD
FEATURE ANOMALIES:	N/A
DISCLAIMER:	NOTIFY MAINTENANCE SUPERVISOR IF THE BMP IS NOT CHARACTERISTIC OF THIS OWNER'S MANUAL TO FACILITATE MAINTENANCE ACTIVITIES. CONTACT MAINTENANCE SUPERINTENDENT BEFORE ANY MAINTENANCE TAKES PLACE. IF SENSITIVE AREAS OR BUFFERS ARE ADJACENT TO FENCE LINE, CONTACT NW REGION ENVIRONMENTAL PROGRAM MANAGER OR MAINTENANCE AREA BMP LEAD TECH PRIOR TO STARTING OF WORK.
DIRECTIONS:	







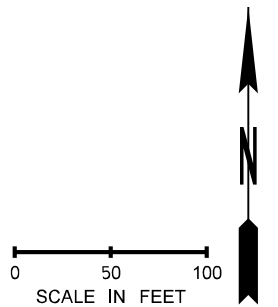
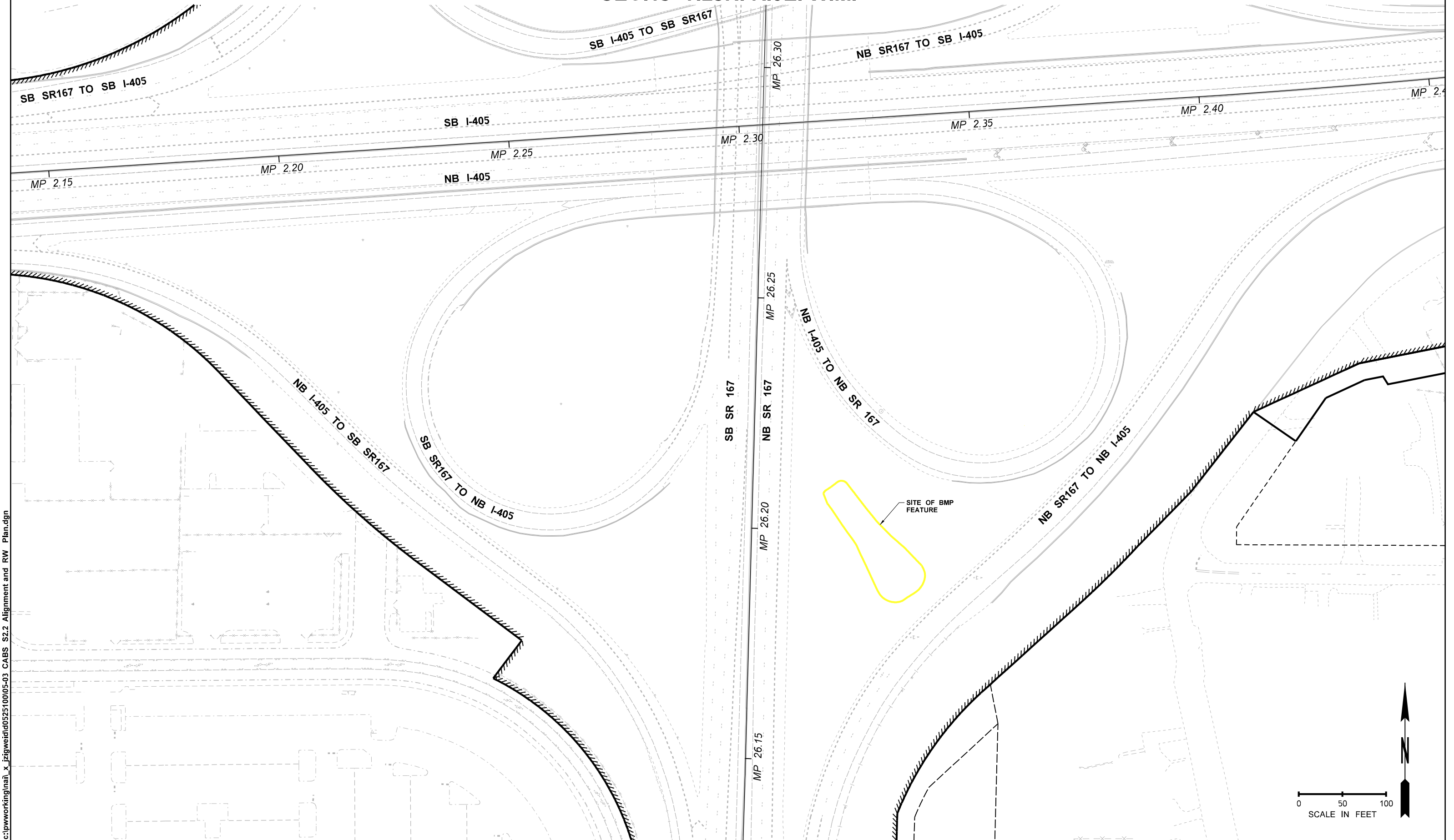
NO.	ITEM	PURPOSE
1	INFLOW STRUCTURE	ALLOWS STORMWATER INTO THE FACILITY WITH ENERGY DISSIPATION TO AVOID EROSION.
2	BOTTOM OF CABS	PROVIDE ENHANCED WATER QUALITY TREATMENT
3	OUTFLOW STRUCTURE	CONTROLS THE RELEASE RATE TO MINIMIZE THE EFFECTS ON THE DOWNSTREAM SYSTEM.
4	PERIMETER EMBANKMENT	PROVIDES STRUCTURALLY SOUND CONTAINMENT OF THE CELL DUE TO SLOPING TOPOGRAPHY.

NO.	ITEM	BMP MAINTENANCE ACTIVITY
NOTE: THE FOLLOWING ITEMS SUPPLEMENT HRM TABLES 5-12 THROUGH 5-24. REFER TO TABLES 5-12 THROUGH 5-24 FOR GENERAL MAINTENANCE ACTIVITIES.		
1	INFLOW STRUCTURE	REFER TO HRM TABLES 5-12 THROUGH 5-24.
2	BOTTOM OF CABS	REFER TO HRM TABLES 5-12 THROUGH 5-24.
3	OUTFLOW STRUCTURE	REFER TO HRM TABLES 5-12 THROUGH 5-24.
4	PERIMETER EMBANKMENT	SEED EXPOSED SOILS WITH NATIVE SEED MIX OR COVER WITH WOOD MULCH.

LEGEND	
	- DRAINAGE STRUCTURE ID CONTINUED
	- STORM SEWER PIPE
	- CATCH BASIN
	- ROCK OUTFALL PROTECTION
	- DRAINAGE DITCH
	- COMPOST AMENDED BIOFILTRATION SWALE
	- EXISTING STORM TO BE REMOVED OR ABANDONED

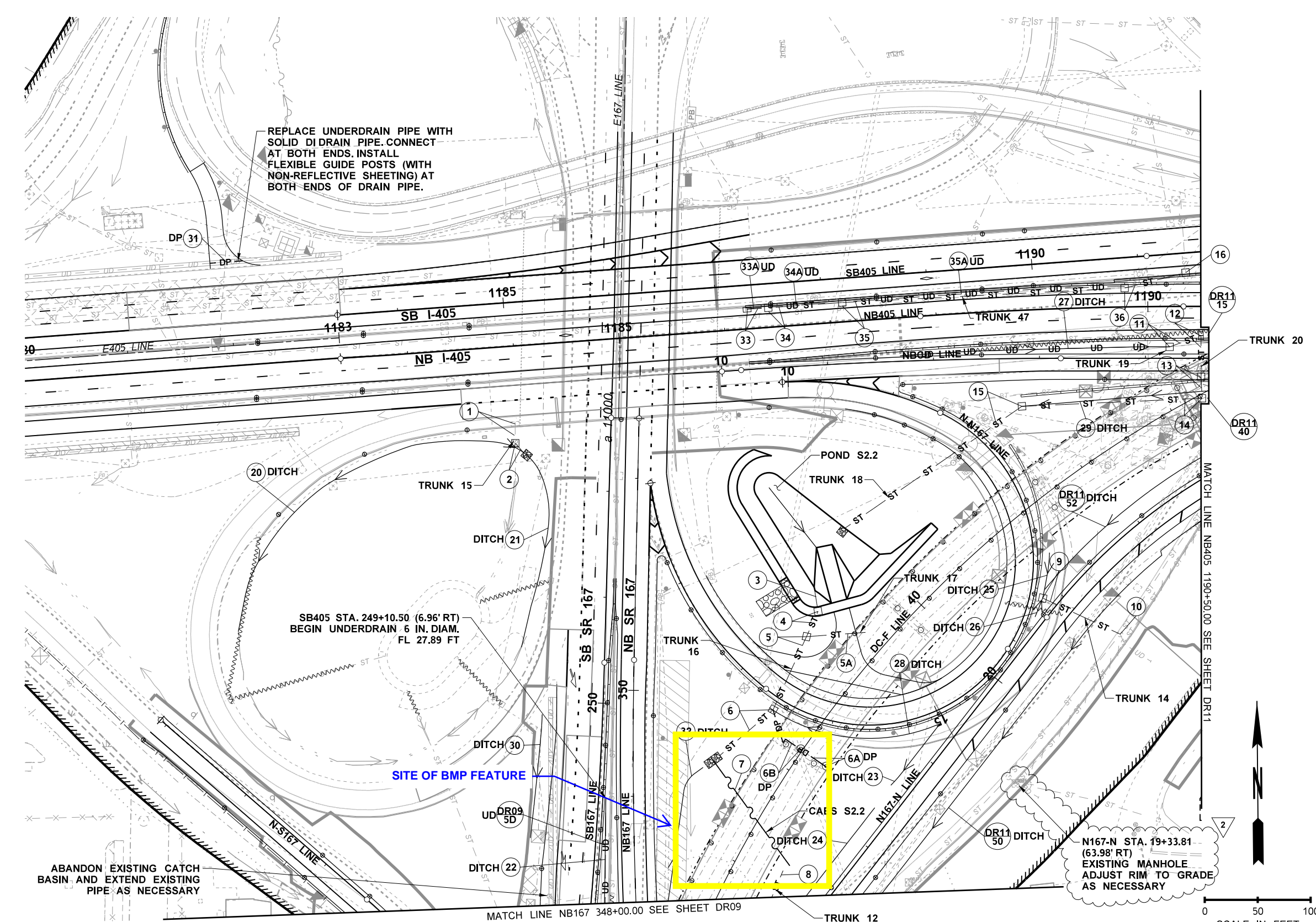


SEC.19 T.23N. R.5E. W.M.





SEC.19 T.23N. R.5E. W.M.



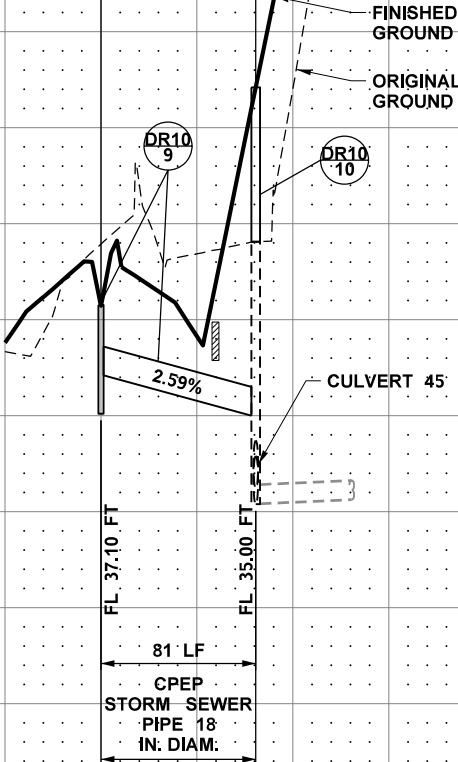
DRAINAGE REFERENCE SUMMARY		
DESCRIPTION	PROFILE/DETAIL	SHEET(S)
TRUNK 12	DP07	
TRUNK 14	DP07	
TRUNK 15	DP08	
TRUNK 16	DP08	
TRUNK 17	DP08	
TRUNK 18	DP09A, DP09B	
TRUNK 19	DP10	
TRUNK 20	DP10	
TRUNK 47	DP25	
POND S2.2	DD10A, DD10B, DD10C	
CABS S2.2	DD20	
DRAIN PIPE DR10-6A	BRIDGE PLANS	
DRAIN PIPE DR10-6B	BRIDGE PLANS	
DITCH DR10-29	DH01	
DITCH DR10-32	DD20	

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MAY 28 2019  
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LEGEND	
①	- DRAINAGE STRUCTURE ID
DR01 1	- DRAINAGE STRUCTURE ID CONTINUED
— ST — ST —	- STORM SEWER PIPE
— UD — UD —	- UNDERDRAIN PIPE
— DP — DP —	- DRAIN PIPE
□	- CATCH BASIN
▣	- GRATE INLET
▤	- DROP INLET
○	- MANHOLE
⊠	- ROCK OUTFALL PROTECTION
→	- DRAINAGE DITCH
~~~~~	- COMPOST AMENDED BIOFILTRATION SWALE
▨	- MEDIA FILTER DRAIN
~~~~~	- EXISTING STORM TO BE REMOVED OR ABANDONED

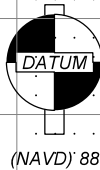
FILE NAME c:\pwworking\atl_x_grimando\0321992\C8811_PS_DR10.dgn			REGION NO. 10 STATE WASH		FED.AID PROJ.NO.			Washington State Department of Transportation	I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR	DRAINAGE PLAN	PLAN REF NO DR10											
TIME 9:22:17 AM	DATE 5/24/2019	PLOTTED BY GlennR	DESIGNED BY J. TURCOTT	ENTERED BY E. JACKSON	CHECKED BY J. ZIGWEID	PROJ. ENGR. C. CHEN						REGIONAL ADM. L. ENG	REV. 2 - RFI0369 5/24/19	REV. 1 - RFI0293 7/9/18	REV. 0 - RFC 6/16/17	REV. B - FINAL REVIEW 4/14/17	REV. A - PRELIMINARY REVIEW 1/27/17	REVISION	DATE	BY	C8811	CONTRACT NO.

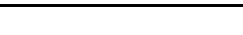





- |    |                                                                                                                                                                                                                                                           |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | STATION, OFFSET, AND RIM ELEVATION FOR STRUCTURES ARE CENTER OF STRUCTURE, UNLESS NOTED OTHERWISE..                                                                                                                                                       |
| 2. | RIM ELEVATIONS ARE APPROXIMATE. CONTRACTOR TO SET RIM AT 1/2 INCH BELOW FINISHED GRADE.                                                                                                                                                                   |
| 3. | STRUCTURE OFFSETS ARE APPROXIMATE. CONTRACTOR TO STAKE THE TOE OF PROPOSED BARRIERS PRIOR TO INSTALLING DRAINAGE STRUCTURES AND INSTALL STRUCTURES AS CLOSE TO THE BARRIER AS POSSIBLE. SEE DETAIL SHEET DD08.                                            |
| 4. | ALL GRATES AND COVERS SHALL BE BOLTED DOWN WITH A 5/8"-NCx2" ALLEN HEAD STAINLESS STEEL CAP SCREW UNLESS OTHERWISE NOTED.                                                                                                                                 |
| 5. | UTILITY ZONES ARE APPROXIMATE. DEPTHS OF UTILITIES HAVE NOT BEEN VERIFIED.                                                                                                                                                                                |
| 7. | CULVERT 76 TO BE REPURPOSED AS A STORM SEWER PIPE.                                                                                                                                                                                                        |
| 8. | GRADE TWO FEET OVER PIPE DR09-16. EXTEND GRADING A MINIMUM 2 FEET FROM THE EASTERN EDGE OF PIPE BEFORE STARTING 2:1 CATCH GRADE AROUND STRUCTURE DR09-16 AND DR09-17 IN THE SAME MANNER. START 2:1 CATCH A MINIMUM 2 FEET FROM THE EDGE OF THE STRUCTURE. |

**SCALE:**  
H: 1"=100'  
V: 1"=10'

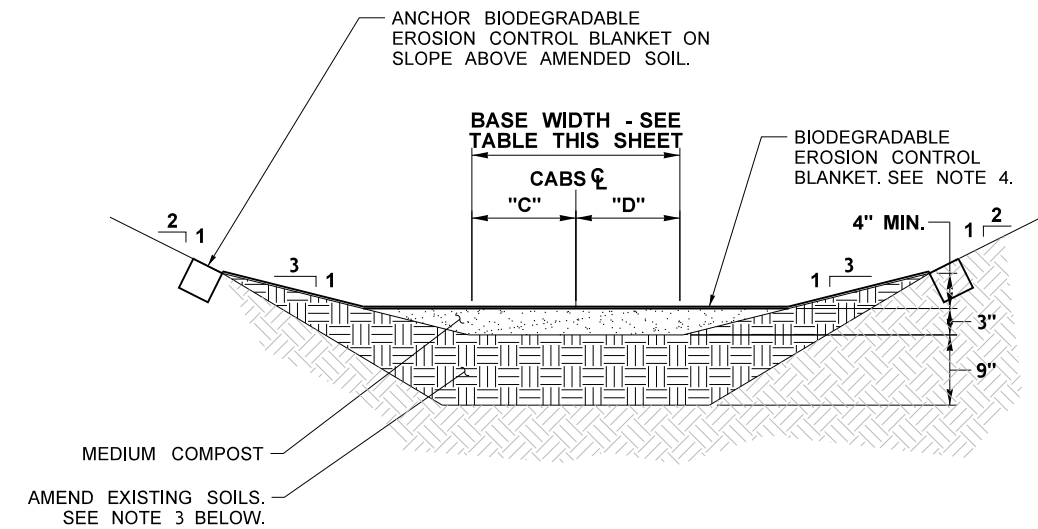


FILE NAME c:\pwworking\l\lail_x_smesc\ld0321992\lC8811_PR_DP07.dgn										 P.E. STAMP BOX		 Washington State Department of Transportation		I-405/SR167 INTERCHANGE DIRECT CONNECTOR		PLAN REF. NO. DP07
TIME 4:19:33 PM				REGION NO. 10	STATE WASH	FED.AID PROJ.NO.		SHEET								
DATE 12/4/2018	REV. 3 - RFI0334	12/6/18							OF							
PLOTTED BY SMesc	REV. 2 - RFI0126	8/31/17														
DESIGNED BY J. TURCOTT	REV. 1 - RFI0126	8/29/17														
ENTERED BY E. JACKSON	REV. 0 - RFC	6/16/17														
CHECKED BY J. ZIGWEID	REV. B - FINAL REVIEW	4/14/17														
PROJ. ENGR. C. CHEN	REV. A - PRELIMINARY REVIEW	1/27/17														
REGIONAL ADM. L. ENG	REVISION	DATE	BY													
				CONTRACT NO. C8811		LOCATION NO.										







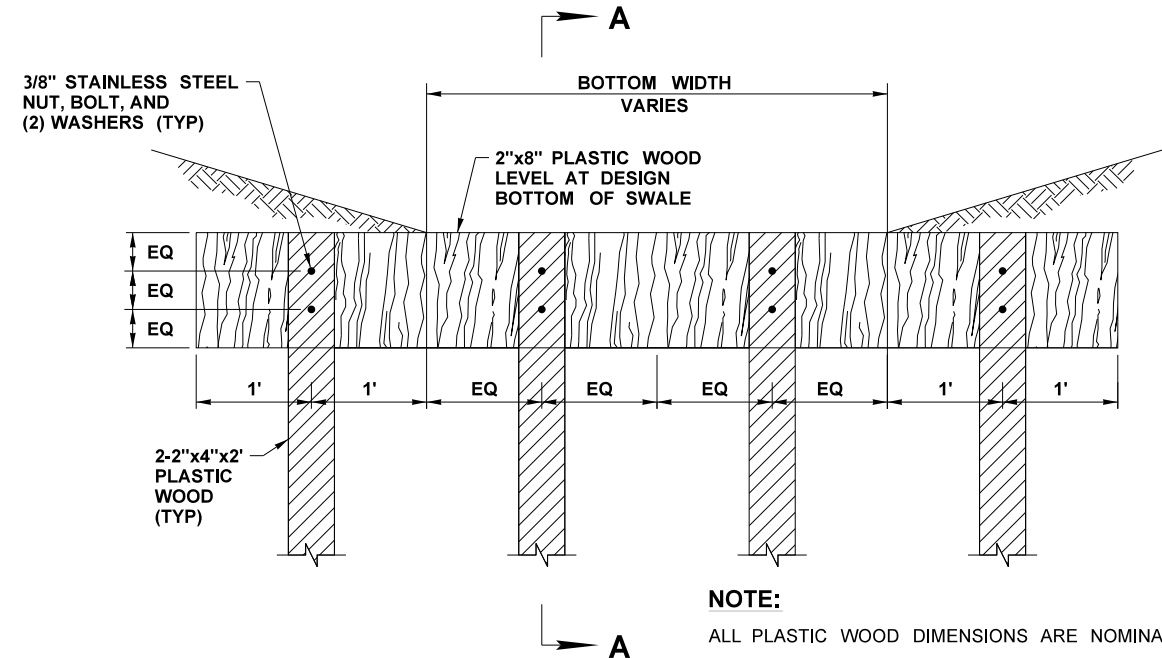


NOTES:

1. REFER TO ROADWAY SECTIONS FOR EDGE CONDITIONS OF SWALE SECTION.
2. CONTRACTOR SHALL AVOID COMPACTION OF NATIVE SOILS BENEATH SWALE.
3. AMEND EXISTING SOILS WITH 3" MEDIUM COMPOST TO A DEPTH OF 9". COMPACT TO ORIGINAL GROUND ELEVATION PRIOR TO PLACEMENT OF 3" MEDIUM COMPOST TOP LIFT.
4. COMPLETELY COVER COMPOST WITH BIODEGRADABLE EROSION CONTROL BLANKET PER STD. I-60.20-01

COMPOST-AMENDED BIOFILTRATION SWALE

N.T.S.



NOTE:

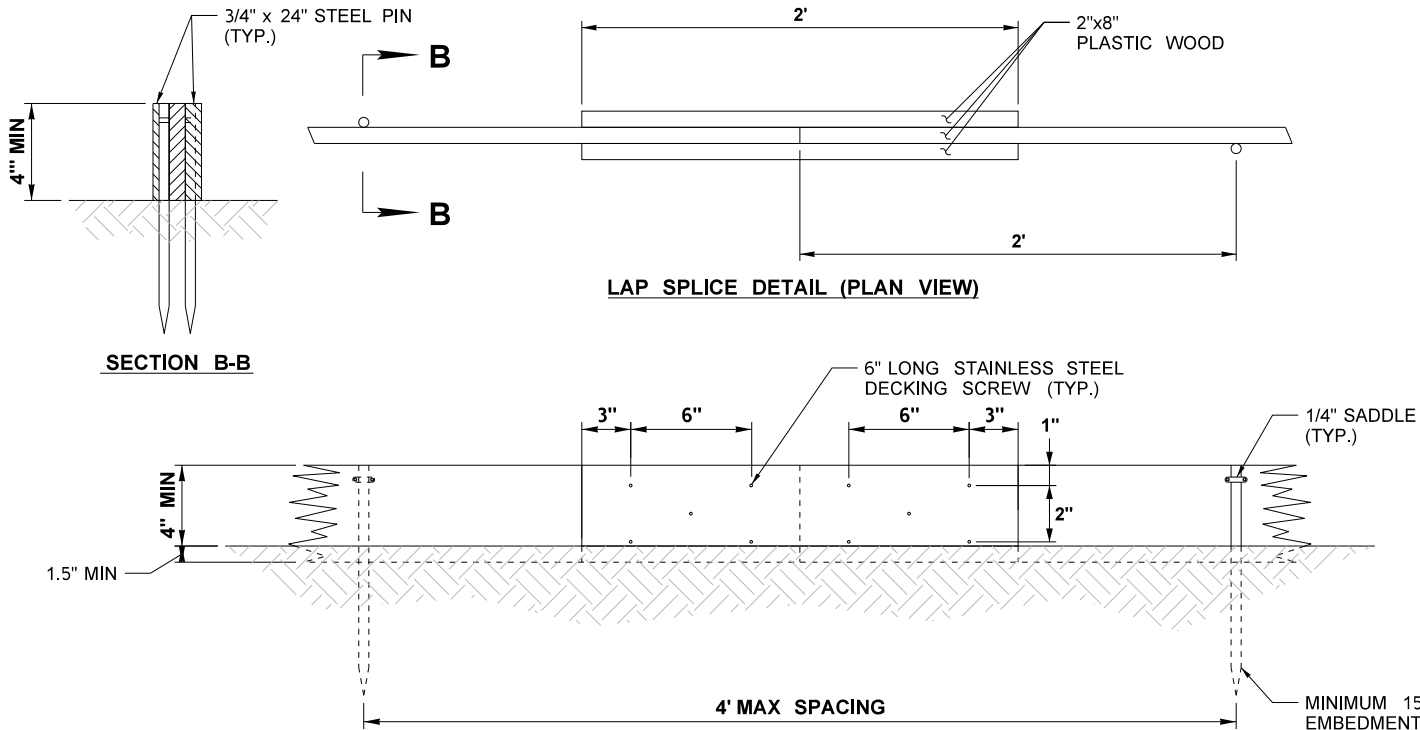
ALL PLASTIC WOOD DIMENSIONS ARE NOMINAL.

FLOW SPREADER DETAIL

N.T.S.

COMPOST-AMENDED BIOFILTRATION SWALE LIMITS

ID	BEGIN STA			END STA			BASE WIDTH (FT)	LEFT OFFSET "C" (FT)	RIGHT OFFSET "D" (FT)	FLOW SPREADER (SEE DETAIL THIS SHEET)	DIVIDER (SEE DETAIL THIS SHEET)
DR10A-5	N / E	173358.28	1295976.84	N / E	173362.35	1295876.93	6	3	3		
DR12-28	SB405-SB	25+35.21	143.56' LT	SB405-SB	26+59.19	110.46' LT	5	2.5	2.5		
DR10-7	NB167	349+33.77	75.99' RT	NB167	348+30.28	196.19' RT	15	7.5	7.5	X	X

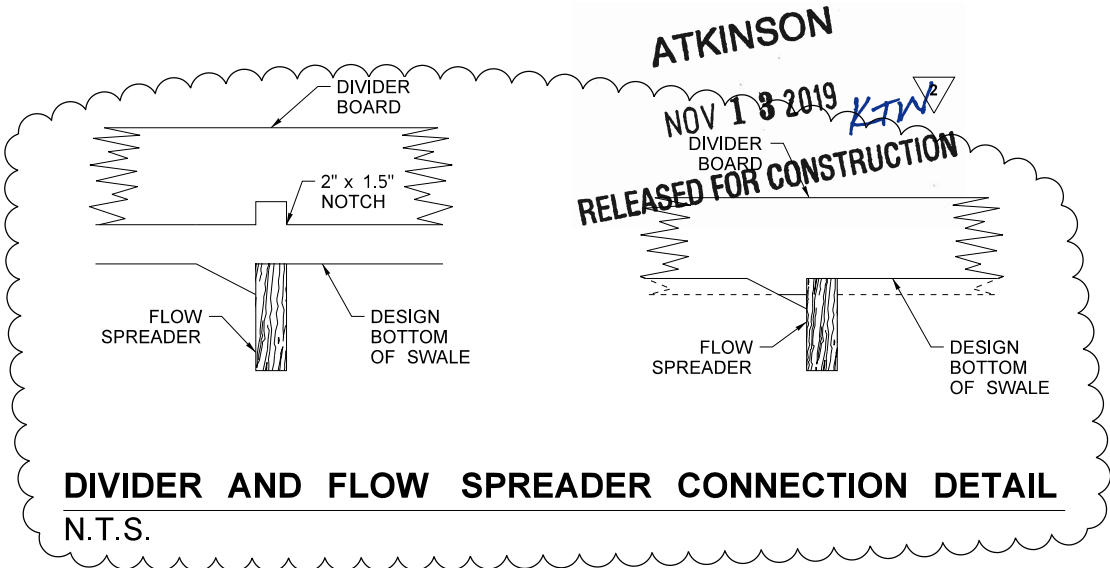


PROFILE NOTE:

ALL PLASTIC WOOD DIMENSIONS ARE NOMINAL.

DIVIDER DETAIL

N.T.S.

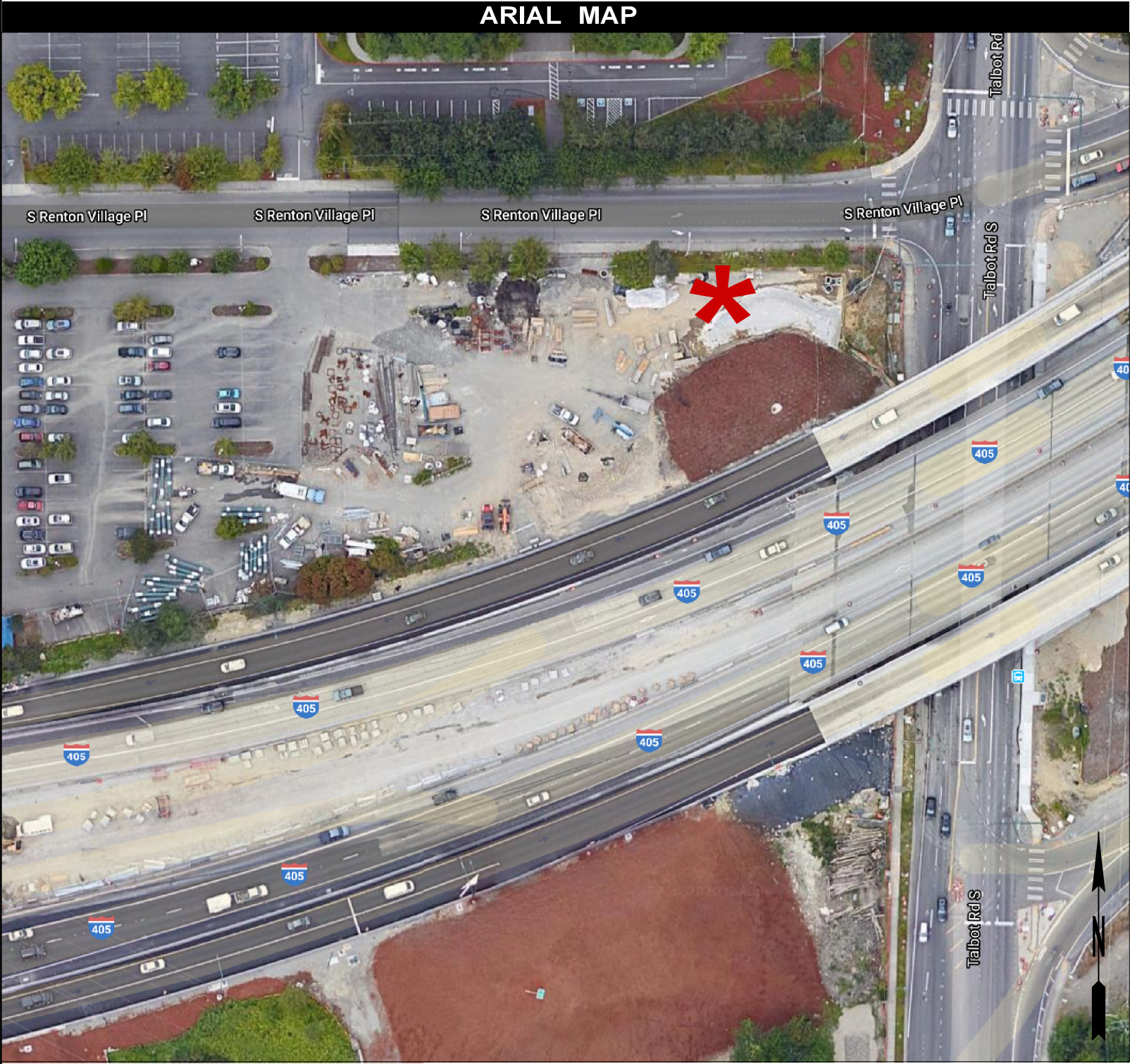


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REV. 2 - RFI 0388		11/11/19		REV. 1 - RFI 0375		08/05/19		REV. 0 - RFC		06/16/17		REV. B - FINAL REVIEW		04/14/17		REV. A - PRELIMINARY REVIEW	
REVISION		DATE		BY		C8811											
REGION NO. 10		STATE WASH		FED.AID PROJ.NO.		JOB NUMBER		CONTRACT NO.		LOCATION NO.		DATE 11/11/19		P.E. STAMP BOX		DATE	
Washington State Department of Transportation		I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR		DRAINAGE DETAILS		PLAN REF NO DD04		SHEET OF SHEETS									

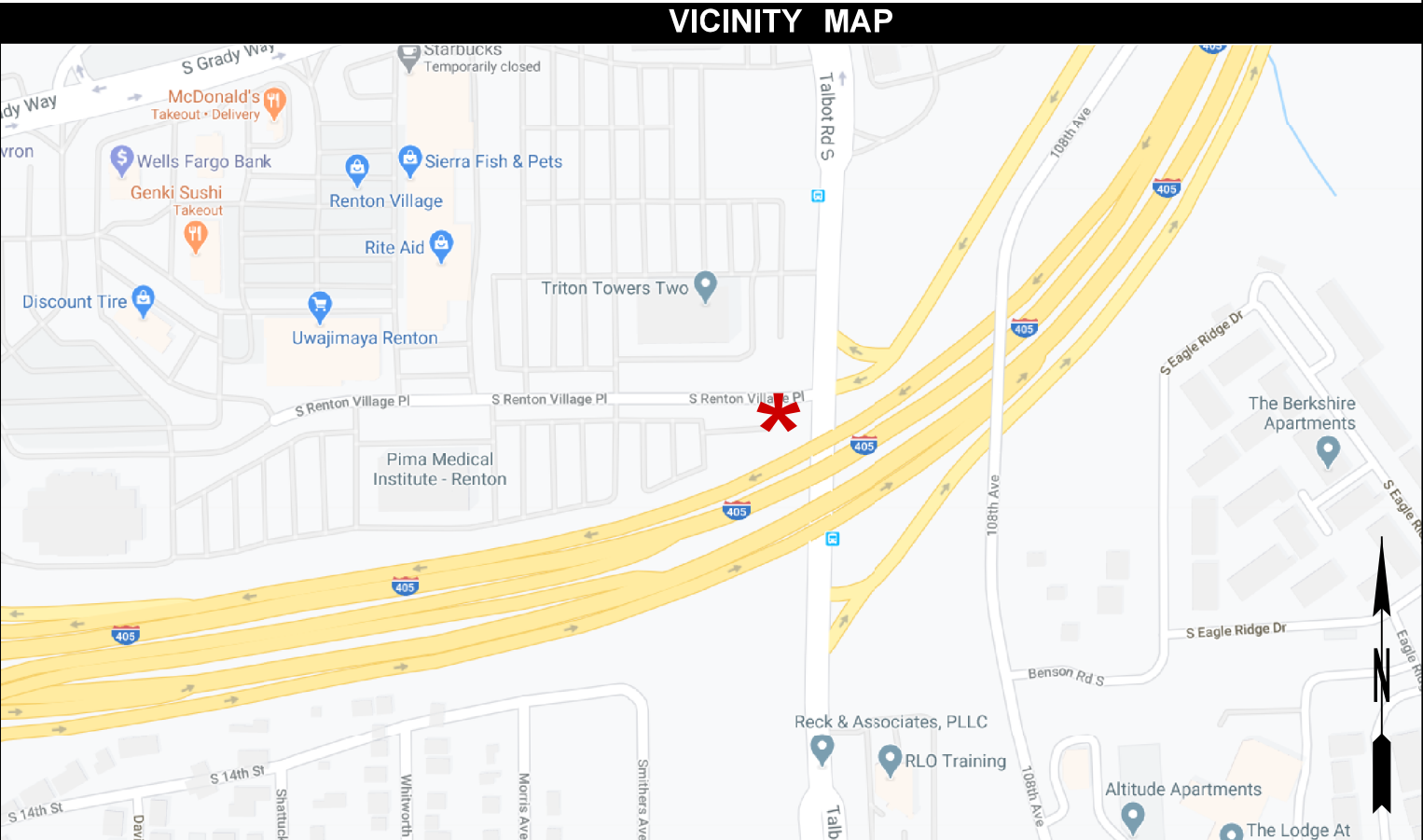




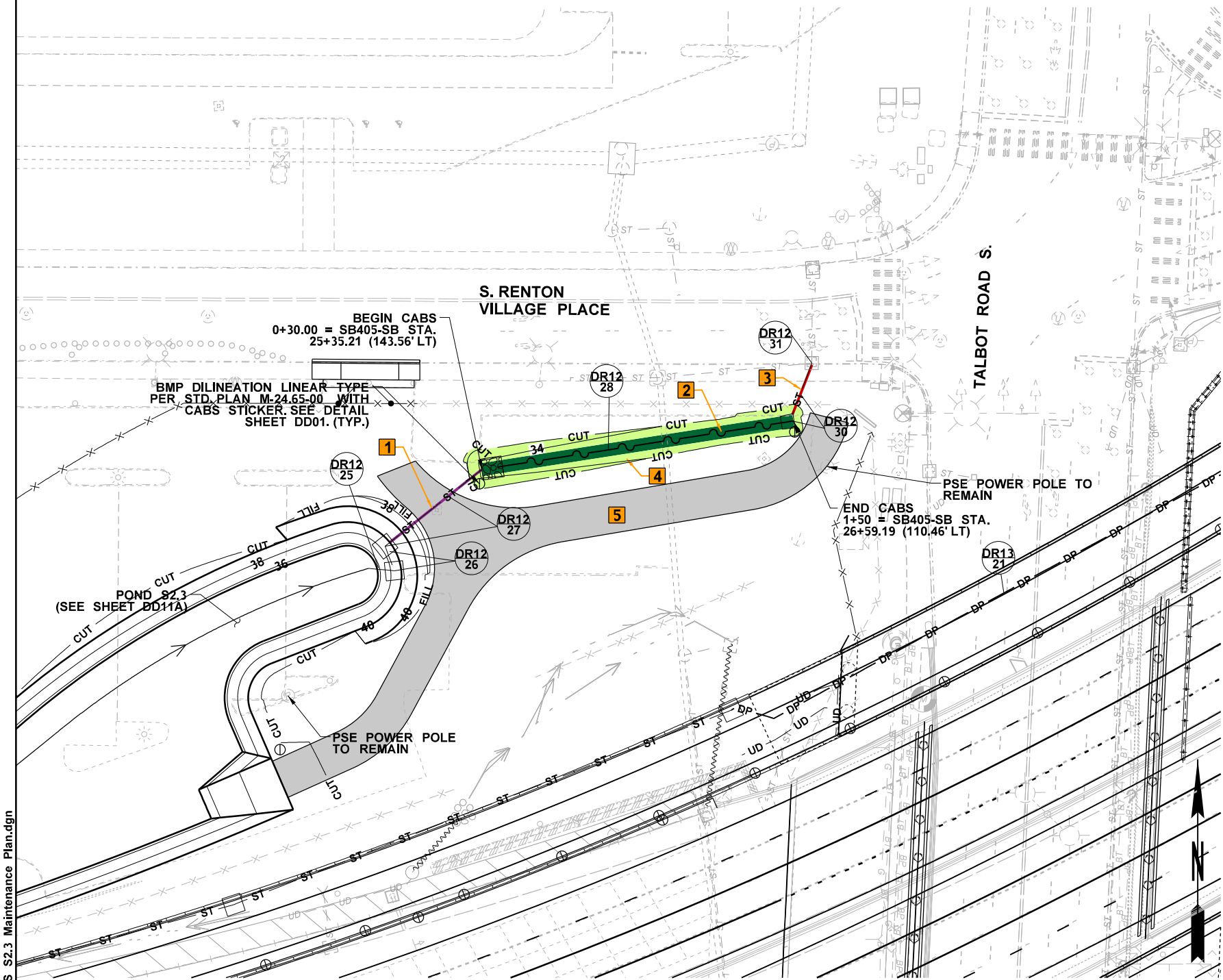




SITE INFORMATION	
LOCATION:	I-405 MP 2.8
FACILITY TYPE:	COMPOST-AMENDED BIOFILTRATION SWALE
MAINTENANCE RESPONSIBILITY:	WSDOT
DESIGN:	OL-XXXX   CONSTRUCTION: 01XXXX   JOB NUMBER: XXXX
HYDRAULIC REPORT	TBD
MODIFIED BY:	N/A
SITE DESCRIPTION:	THIS IS A 120 LF FACILITY PROVIDING ENHANCED WATER QUALITY TREATMENT.
AS-BUILT FIELD VERIFICATION:	N/A
SURVEY BENCH MARK:	TBD
FEATURE ANOMALIES:	N/A
DISCLAIMER:	NOTIFY MAINTENANCE SUPERVISOR IF THE BMP IS NOT CHARACTERISTIC OF THIS OWNER'S MANUAL TO FACILITATE MAINTENANCE ACTIVITIES. CONTACT MAINTENANCE SUPERINTENDENT BEFORE ANY MAINTENANCE TAKES PLACE. IF SENSITIVE AREAS OR BUFFERS ARE ADJACENT TO FENCE LINE, CONTACT NW REGION ENVIRONMENTAL PROGRAM MANAGER OR MAINTENANCE AREA BMP LEAD TECH PRIOR TO STARTING OF WORK.
DIRECTIONS:	





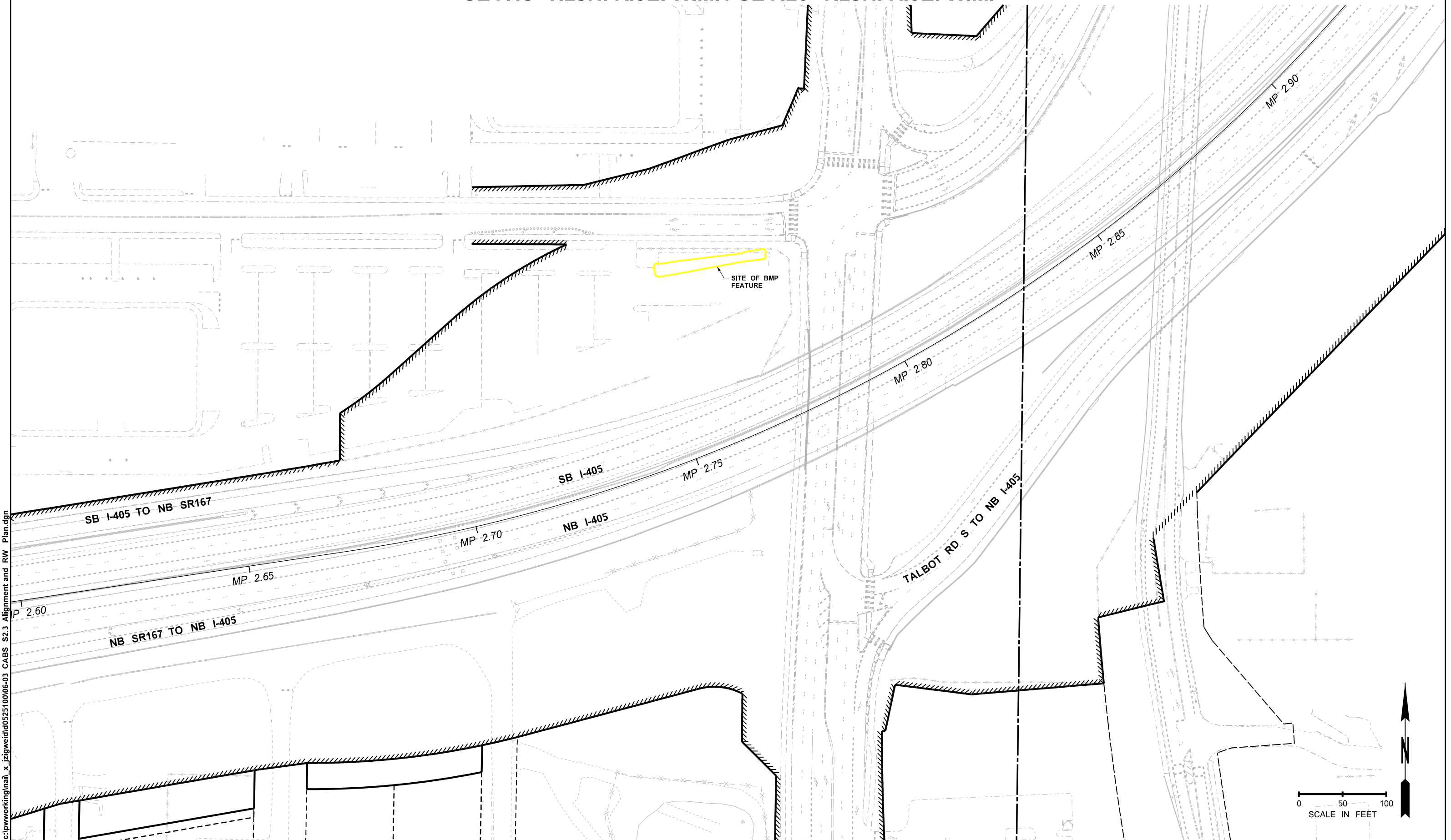


NO.	ITEM	PURPOSE
1	INFLOW STRUCTURE	ALLOWS STORMWATER INTO THE FACILITY WITH ENERGY DISSIPATION TO AVOID EROSION.
2	BOTTOM OF CABS	PROVIDE ENHANCED WATER QUALITY TREATMENT
3	OUTFLOW STRUCTURE	CONTROLS THE RELEASE RATE TO MINIMIZE THE EFFECTS ON THE DOWNSTREAM SYSTEM.
4	PERIMETER EMBANKMENT	PROVIDES STRUCTURALLY SOUND CONTAINMENT OF THE CELL DUE TO SLOPING TOPOGRAPHY.
5	ACCESS ROAD	SAFE, CLEAR ACCESS TO SITE WITH PROPER SITE IDENTIFICATION SIGNING.

NO.	ITEM	BMP MAINTENANCE ACTIVITY
NOTE: THE FOLLOWING ITEMS SUPPLEMENT HRM TABLES 5-12 THROUGH 5-24. REFER TO TABLES 5-12 THROUGH 5-24 FOR GENERAL MAINTENANCE ACTIVITIES.		
1	INFLOW STRUCTURE	REFER TO HRM TABLES 5-12 THROUGH 5-24.
2	BOTTOM OF CABS	REFER TO HRM TABLES 5-12 THROUGH 5-24.
3	OUTFLOW STRUCTURE	REFER TO HRM TABLES 5-12 THROUGH 5-24.
4	PERIMETER EMBANKMENT	SEED EXPOSED SOILS WITH NATIVE SEED MIX OR COVER WITH WOOD MULCH.
5	ACCESS ROAD	REMOVE A MINIMUM AMOUNT OF VEGETATION TO PROVIDE CLEAR ACCESS ALONG ACCESS ROAD.

LEGEND	
	- DRAINAGE STRUCTURE ID CONTINUED
	- STORM SEWER PIPE
	- CATCH BASIN
	- ROCK OUTFALL PROTECTION
	- DRAINAGE DITCH
	- COMPOST AMENDED BIOFILTRATION SWALE
	- EXISTING STORM TO BE REMOVED OR ABANDONED





c:\pwworking\atl\_x\_jzgweid\052510006-03 CABS S2.3 Alignment and RW Plan.dgn



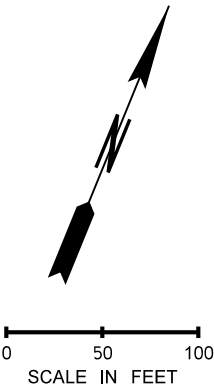
SEC.19 T.23N. R.5E. W.M.

DRAINAGE REFERENCE SUMMARY

DESCRIPTION	PROFILE/DETAIL SHEET(S)
TRUNK 18	DP09A, DP09B
TRUNK 22	DP11
TRUNK 23	DP12
TRUNK 25	DP13
TRUNK 32	DP16
TRUNK 33	DP16
TRUNK 34	DP16
TRUNK 35	DP17
TRUNK 36	DP18
TRUNK 37	DP19
TRUNK 38	DP19
TRUNK 39	DP20
POND S2.3	DD11A, DD11B
CABS S2.3	DD22
DRAIN PIPE DR12-12C	DP54
DRAIN PIPE DR12-14B	DP54
DRAIN PIPE DR12-18B	DP54
DRAIN PIPE DR12-44B	DP55
DRAIN PIPE DR12-19B	DP56

NOTES:

- SEE PLAN SHEET DD141-DD145 AND DP141-DP142 FOR DRAINAGE RELATED WORK ON 14TH ST.
- SEE DRAINAGE PLAN ENLARGEMENTS SHEETS DD30-DD33.



LEGEND

- ① - DRAINAGE STRUCTURE ID
- DR01 ① - DRAINAGE STRUCTURE ID CONTINUED
- ST — ST — STORM SEWER PIPE
- UD — UD — UNDERDRAIN PIPE
- DP — DP — DRAIN PIPE
- - CATCH BASIN
- ▣ - GRATE INLET
- ▤ - DROP INLET
- - MANHOLE
- ▣ - ROCK OUTFALL PROTECTION
- - DRAINAGE DITCH
- ~ - COMPOST AMENDED BIOFILTRATION SWALE
- ▨ - MEDIA FILTER DRAIN
- ~~~~~ - EXISTING STORM TO BE REMOVED OR ABANDONED

ATKINSON

JUL 24 2019 KTW

RELEASED FOR CONSTRUCTION

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TIME 10:11:02 AM

DATE 7/23/2019

PLOTTED BY JeffZ

DESIGNED BY J. TURCOTT

ENTERED BY E. JACKSON

CHECKED BY J. ZIGWEID

PROJ. ENGR. C. CHEN

REGIONAL ADM. L. ENG

REV. 6 - RFI0373 & RFI0374

REV. 5 - RFI0367

REV. 4 - RFI0252

REV. 3 - RFI0242

REV. 2 - RFI0202

REV. 1 - RFI0057

REV. 0 - RFC

REVISION

7/16/19

5/1/19

4/6/18

3/19/18

1/15/18

6/16/17

6/02/17

DATE

BY

REGION NO.

STATE

10 WASH

JOB NUMBER

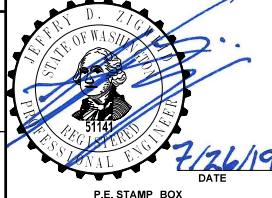
CONTRACT NO.

C8811

LOCATION NO.

FED.AID PROJ.NO.

DATE



P.E. STAMP BOX

DATE



I-405 / SR 167 INTERCHANGE  
DIRECT CONNECTOR

DRAINAGE PLAN

PLAN REF NO

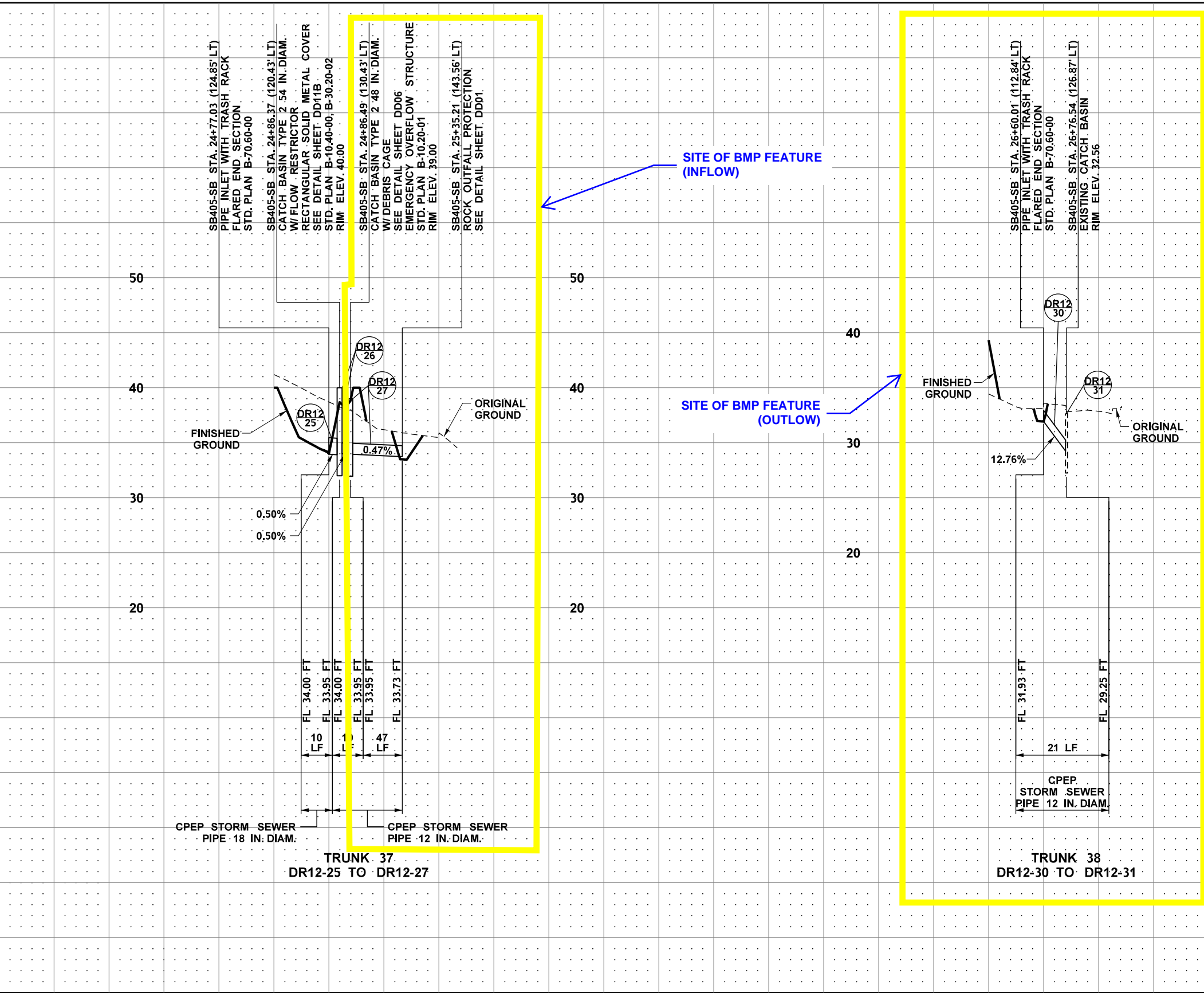
DR12

SHEET

OF

SHEETS

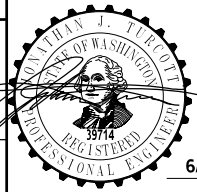





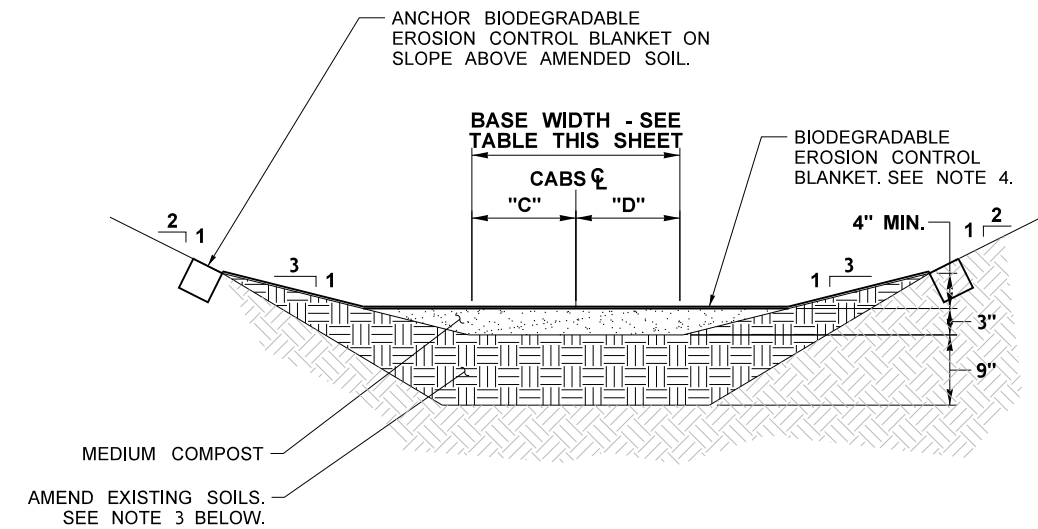
- NOTES:**
1. STATION, OFFSET, AND RIM ELEVATION FOR STRUCTURES ARE CENTER OF STRUCTURE, UNLESS NOTED OTHERWISE.
  2. RIM ELEVATIONS ARE APPROXIMATE. CONTRACTOR TO SET RIM AT 1/2 INCH BELOW FINISHED GRADE.
  3. STRUCTURE OFFSETS ARE APPROXIMATE. CONTRACTOR TO STAKE THE TOE OF PROPOSED BARRIERS PRIOR TO INSTALLING DRAINAGE STRUCTURES AND INSTALL STRUCTURES AS CLOSE TO THE BARRIER AS POSSIBLE. SEE DETAIL SHEET DD08.
  4. ALL GRATES AND COVERS SHALL BE BOLTED DOWN WITH A 5/8"-NCx2" ALLEN HEAD STAINLESS STEEL CAP SCREW UNLESS OTHERWISE NOTED.

ATKINSON  
JUN 15 2017  
RELEASED FOR CONSTRUCTION

SCALE:  
H: 1"=100'  
V: 1"=10'  
(NAVD) 88

FILE NAME c:\pwworking\naill_x_ejackson\ld0321992\C8811_PR_DP19.dgn		REGION NO. STATE		FED.AID PROJ.NO.				 Washington State Department of Transportation		I-405/SR167 INTERCHANGE DIRECT CONNECTOR  DRAINAGE PROFILES		PLAN REF. NO. DP19	
TIME 10:45:46 AM		10	WASH									SHEET	
DATE 6/9/2017												OF	
DESIGNED BY J. TURCOTT	REV. 0 - RFC	6/16/17										SHEETS	
ENTERED BY E. JACKSON	REV. B - FINAL REVIEW	4/14/17				CONTRACT NO. C8811		LOCATION NO.					
CHECKED BY J. ZIGWEID	REV. A - PRELIMINARY REVIEW	1/27/17				DATE 6/16/17		DATE					
PROJ. ENGR. C. CHEN						P.E. STAMP BOX		P.E. STAMP BOX					
REGIONAL ADM. L. ENG	REVISION	DATE	BY										



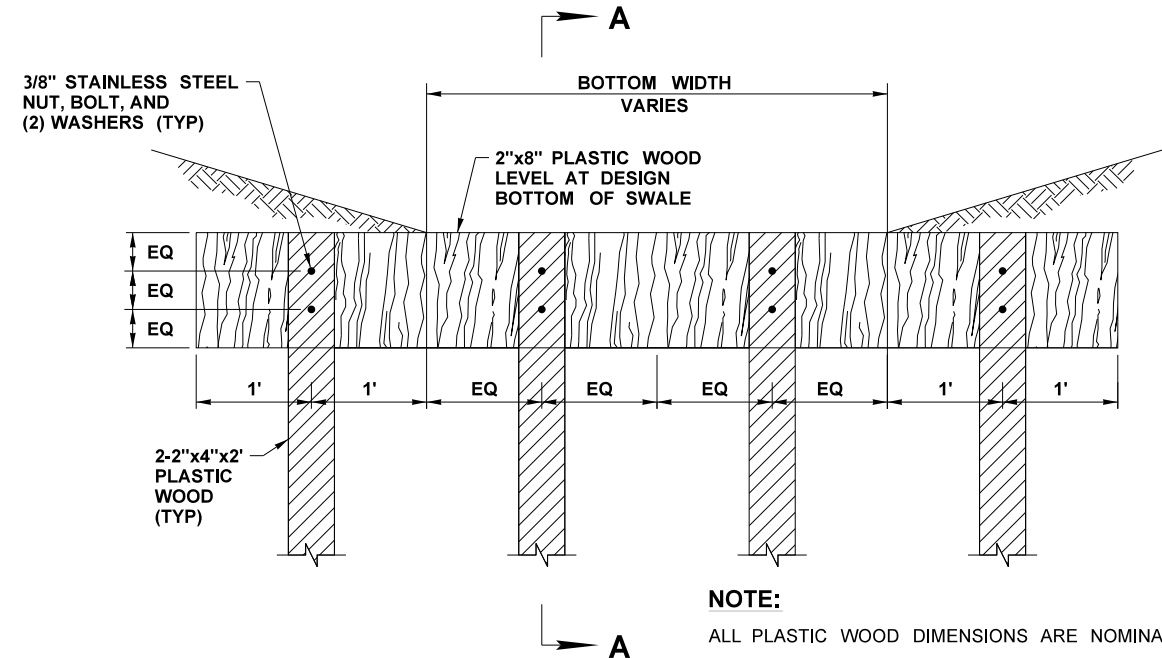


NOTES:

1. REFER TO ROADWAY SECTIONS FOR EDGE CONDITIONS OF SWALE SECTION.
2. CONTRACTOR SHALL AVOID COMPACTION OF NATIVE SOILS BENEATH SWALE.
3. AMEND EXISTING SOILS WITH 3" MEDIUM COMPOST TO A DEPTH OF 9". COMPACT TO ORIGINAL GROUND ELEVATION PRIOR TO PLACEMENT OF 3" MEDIUM COMPOST TOP LIFT.
4. COMPLETELY COVER COMPOST WITH BIODEGRADABLE EROSION CONTROL BLANKET PER STD. I-60.20-01

COMPOST-AMENDED BIOFILTRATION SWALE

N.T.S.



NOTE:

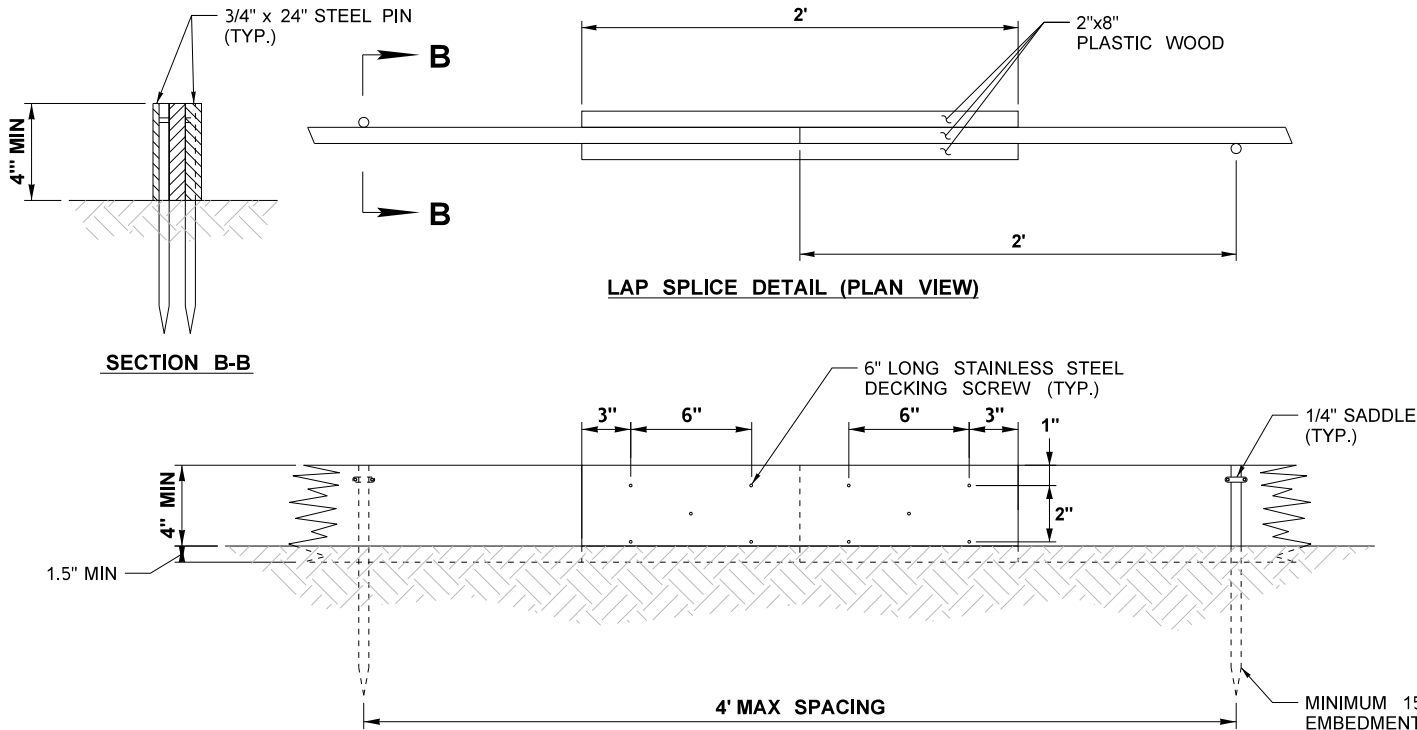
ALL PLASTIC WOOD DIMENSIONS ARE NOMINAL.

FLOW SPREADER DETAIL

N.T.S.

COMPOST-AMENDED BIOFILTRATION SWALE LIMITS

ID	BEGIN STA			END STA			BASE WIDTH (FT)	LEFT OFFSET "C" (FT)	RIGHT OFFSET "D" (FT)	FLOW SPREADER (SEE DETAIL THIS SHEET)	DIVIDER (SEE DETAIL THIS SHEET)
DR10A-5	N / E	173358.28	1295976.84	N / E	173362.35	1295876.93	6	3	3		
DR12-28	SB405-SB	25+35.21	143.56' LT	SB405-SB	26+59.19	110.46' LT	5	2.5	2.5		
DR10-7	NB167	349+33.77	75.99' RT	NB167	348+30.28	196.19' RT	15	7.5	7.5	X	X

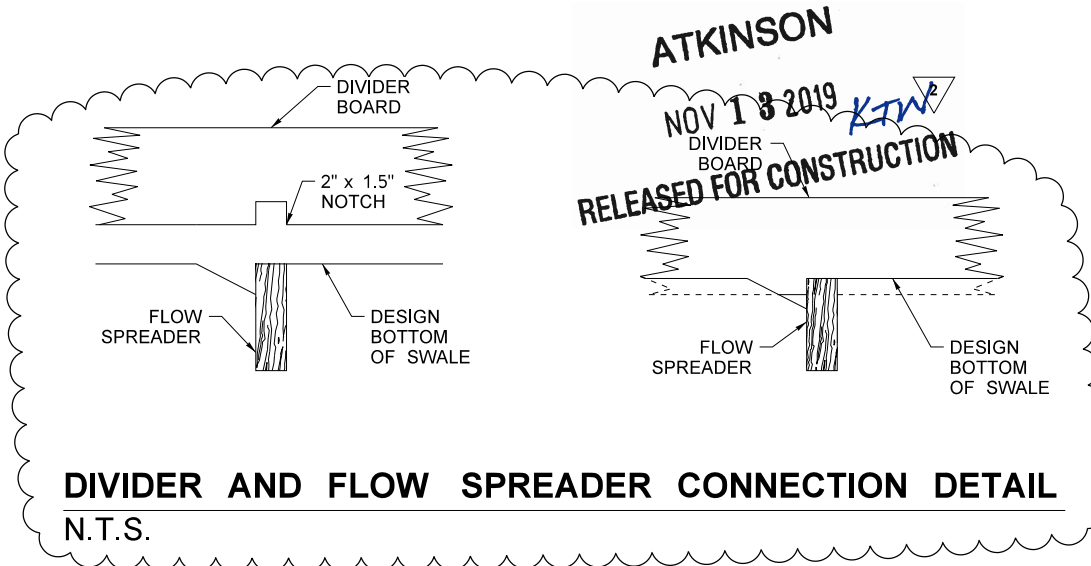


PROFILE NOTE:

ALL PLASTIC WOOD DIMENSIONS ARE NOMINAL.

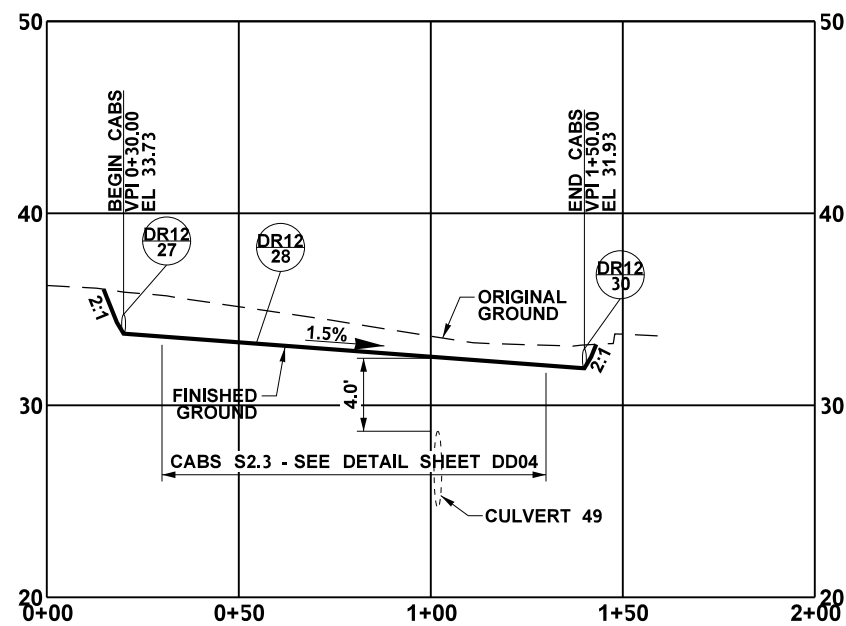
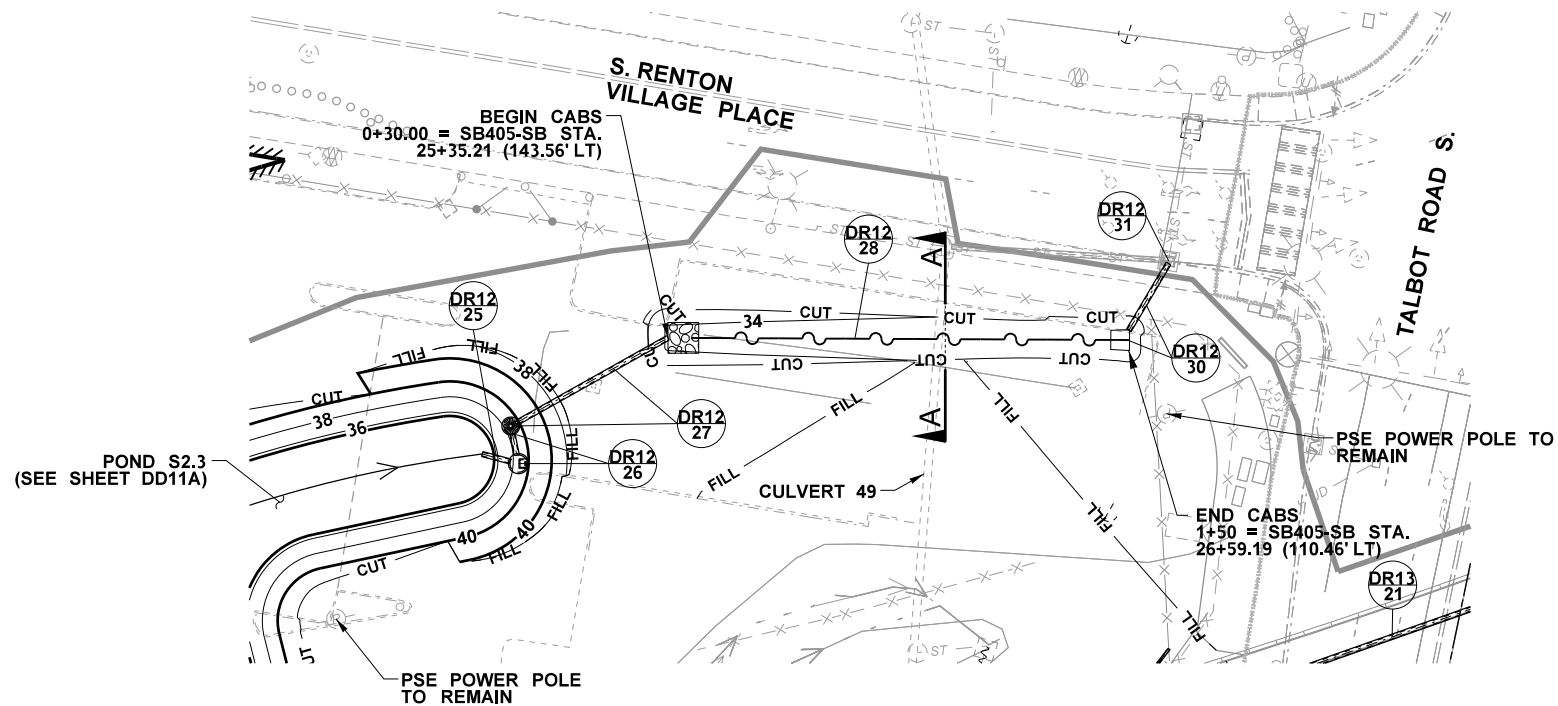
DIVIDER DETAIL

N.T.S.

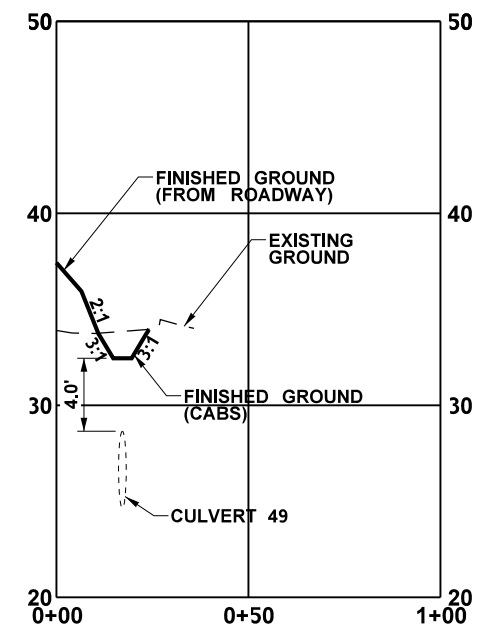


FILE NAME c:\pwworking\atl\ex-mail\load0321992\I-405_DE_DD04.dgn		TIME 9:40:47 AM		DATE 11/11/2019		PLOTTED BY AndrewM		DESIGNED BY J. TURCOTT		ENTERED BY E. JACKSON		CHECKED BY J. ZIGWEID		PROJ. ENGR. C. CHEN		REGIONAL ADM. L. ENG	
REV. 2 - RFI 0388		11/11/19		REV. 1 - RFI 0375		08/05/19		REV. 0 - RFC		06/16/17		REV. B - FINAL REVIEW		04/14/17		REV. A - PRELIMINARY REVIEW	
REVISION		DATE		BY		C8811		FED.AID PROJ.NO.		LOCATION NO.		DATE		DATE		DATE	
10 WASH		JOB NUMBER		CONTRACT NO.		C8811		WASHINGTON STATE DEPARTMENT OF TRANSPORTATION		I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR		DRAINAGE DETAILS		PLAN REF NO DD04		SHEET OF SHEETS	







**CABS PROFILE (S2.3)**  
HORIZ: 1"=50'  
VERT: 1"=10'



**CABS SECTION A-A (S2.3)**  
HORIZ: 1"=50'  
VERT: 1"=10'

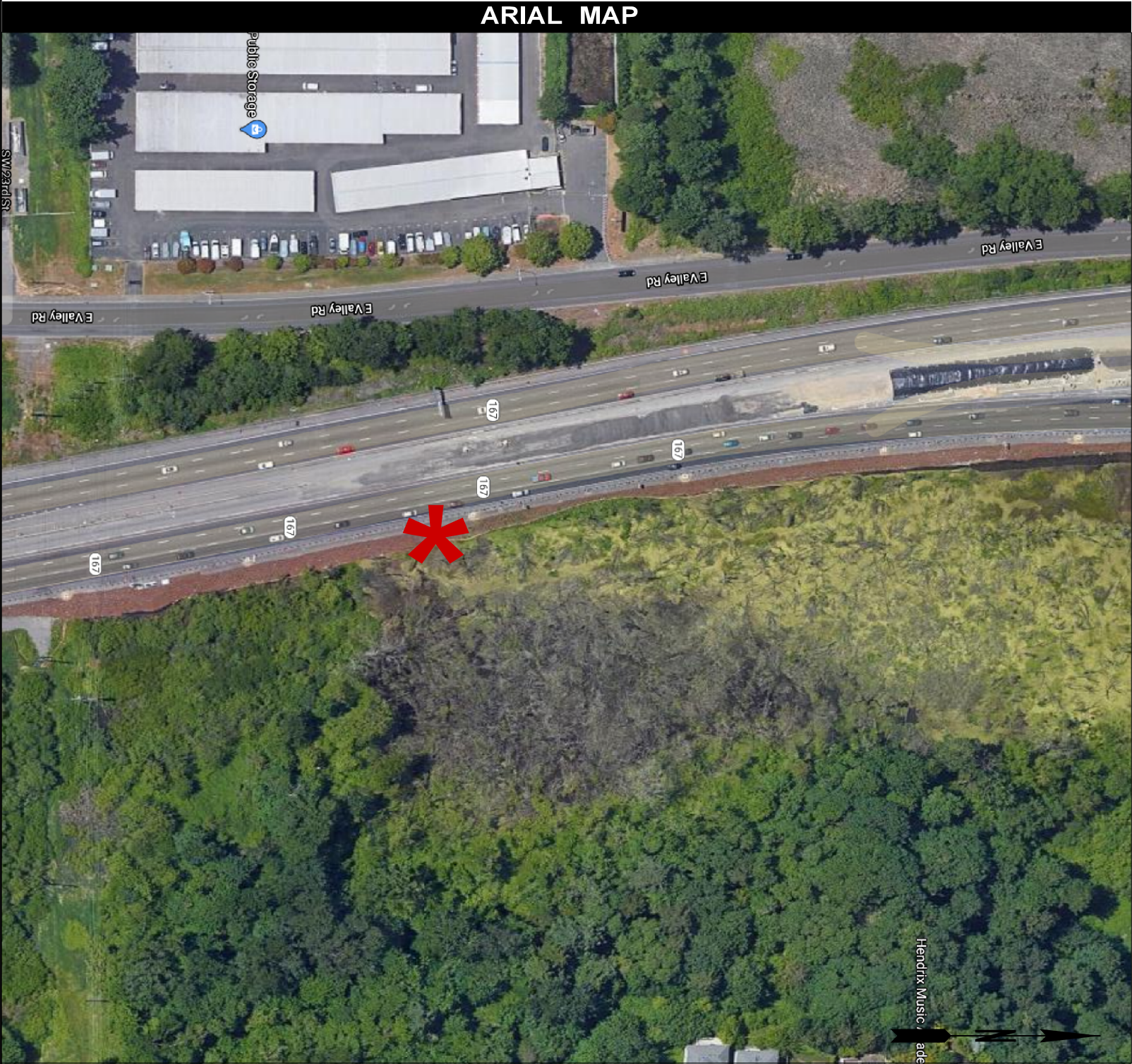


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JUN 15 2017 *RSA*  
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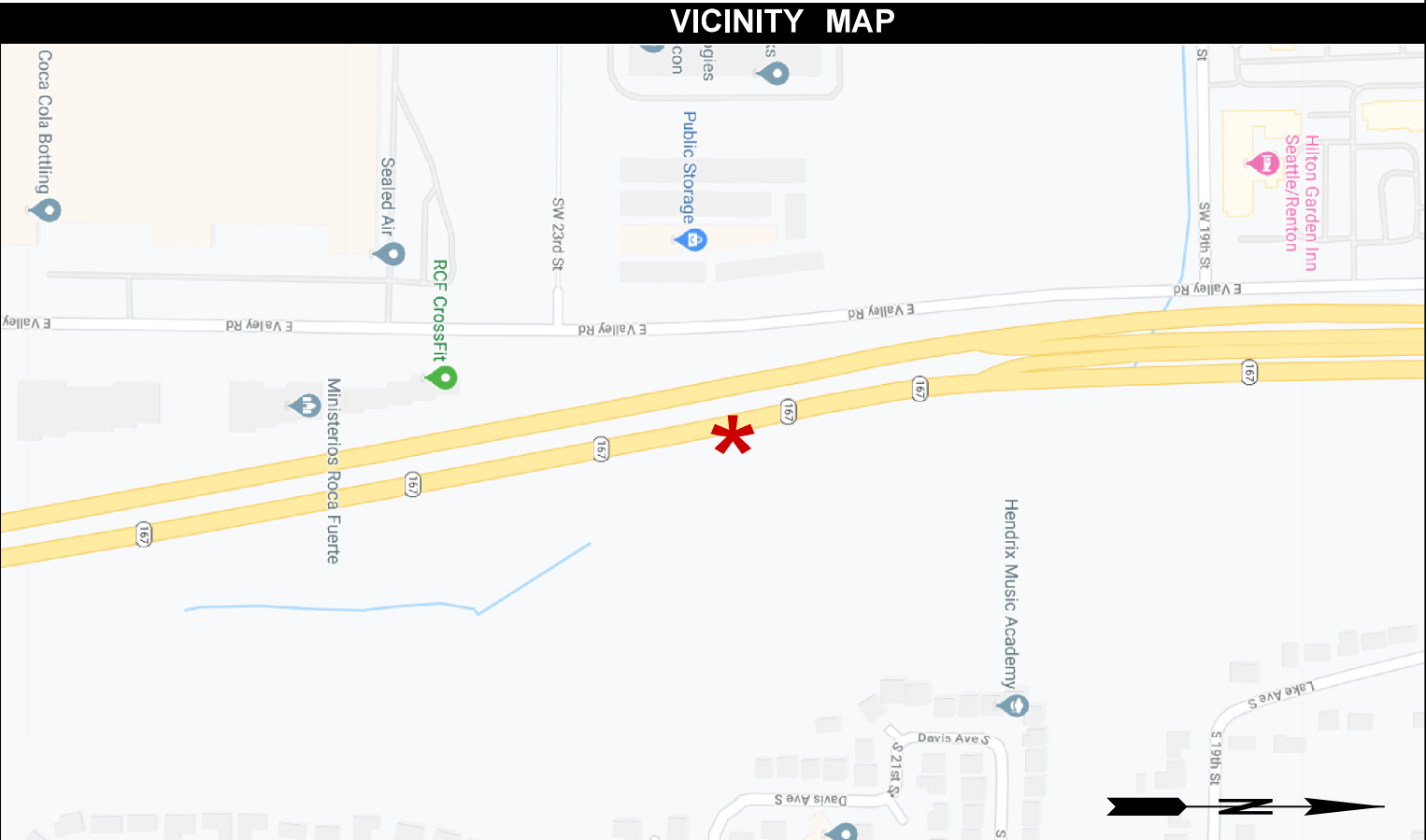
FILE NAME c:\pwworking\atl_x_jzigweid\0321992\C8811_DE_DD22.dgn												DATE 6/16/17		 Washington State Department of Transportation		I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR		PLAN REF NO DD22
TIME 10:40:00 AM				REGION NO. 10	STATE WASH	FED.AID PROJ.NO.			SHEET									
DATE 6/12/2017				JOB NUMBER		CONTRACT NO. C8811		LOCATION NO.								OF		
PLOTTED BY JZigweid														SHEETS				
DESIGNED BY J. TURCOTT																		
ENTERED BY E. JACKSON	REV. 0 - RFC	6/16/17																
CHECKED BY J. ZIGWEID	REV. B - FINAL REVIEW	4/14/17																
PROJ. ENGR. C. CHEN	REV. A - PRELIMINARY REVIEW	1/27/17																
REGIONAL ADM. L. ENG	REVISION	DATE	BY															

**CABS DETAIL DR12-28**

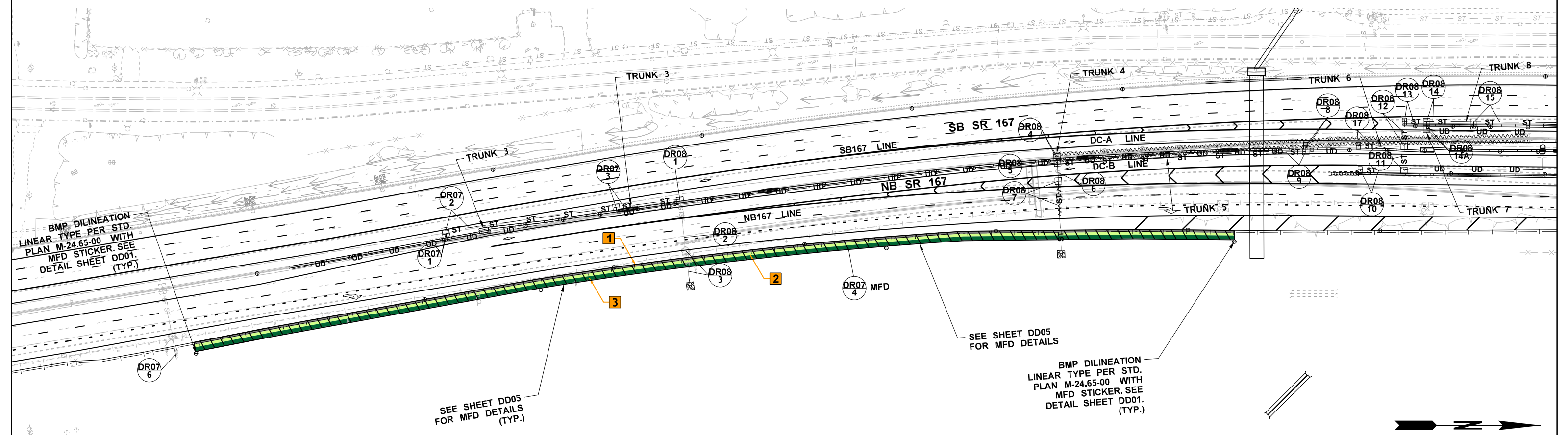




SITE INFORMATION	
LOCATION:	SR 167 MP 25.7 TO MP 25.9
FACILITY TYPE:	MEDIA FILTER DRAIN
MAINTENANCE RESPONSIBILITY:	WSDOT
DESIGN:	OL-XXXX   CONSTRUCTION: 01XXXX   JOB NUMBER: XXXX
HYDRAULIC REPORT	TBD
MODIFIED BY:	N/A
SITE DESCRIPTION:	THIS IS A 1,120 LF MEDIA FILTER DRAIN PROVIDING ENHANCED WATER QUALITY.
AS-BUILT FIELD VERIFICATION:	N/A
SURVEY BENCH MARK:	TBD
FEATURE ANOMALIES:	N/A
DISCLAIMER:	NOTIFY MAINTENANCE SUPERVISOR IF THE BMP IS NOT CHARACTERISTIC OF THIS OWNER'S MANUAL TO FACILITATE MAINTENANCE ACTIVITIES. CONTACT MAINTENANCE SUPERINTENDENT BEFORE ANY MAINTENANCE TAKES PLACE.
DIRECTIONS:	





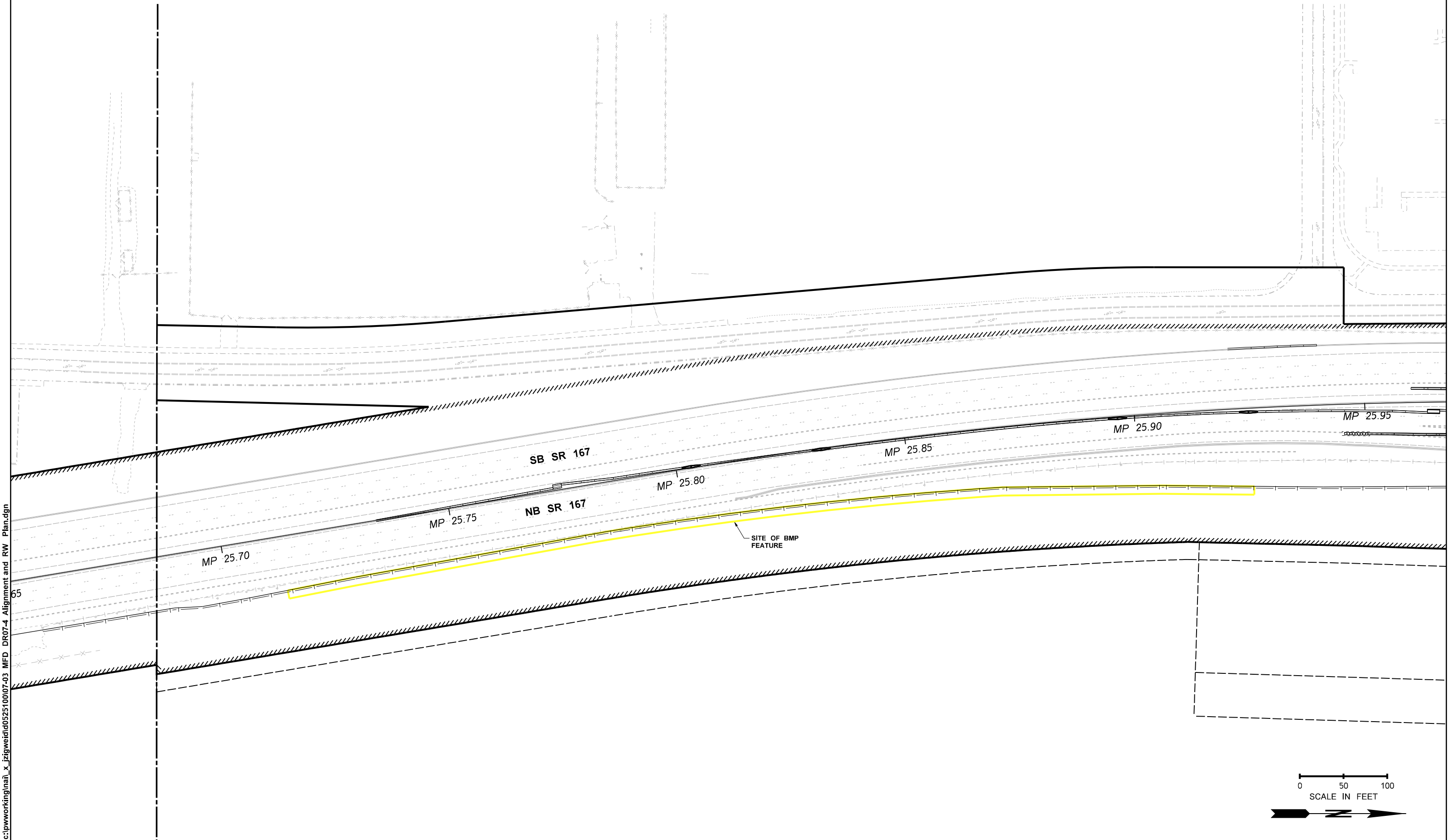


NO.	ITEM	PURPOSE
1	NON-VEGETATION ZONE	ENSURES DISPERSION AND PROVIDES SOME POLUTANT TRAPPING.
2	GRASS STRIP	PROVIDES PRETREATMENT AND SEDIMENT REMOVAL.
3	MEDIA FILTER DRAIN MIX	PROVIDE ENHANCED WATER QUALITY TREATMENT.

NO.	ITEM	BMP MAINTENANCE ACTIVITY
NOTE: THE FOLLOWING ITEMS SUPPLEMENT HRM TABLES 5-12 THROUGH 5-24. REFER TO TABLES 5-12 THROUGH 5-24 FOR GENERAL MAINTENANCE ACTIVITIES.		
1	NON-VEGETATION ZONE	REMOVE ALL VEGETATION FROM NON-VEGETATION ZONE.
2	GRASS STRIP	REFER TO HRM TABLES 5-12 THROUGH 5-24.
3	MEDIA FILTER DRAIN MIX	REFER TO HRM TABLES 5-12 THROUGH 5-24.

LEGEND	
	- DRAINAGE STRUCTURE ID CONTINUED
	- STORM SEWER PIPE
	- CATCH BASIN
	- ROCK OUTFALL PROTECTION
	- MEDIA FILTER DRAIN
	- EXISTING STORM TO BE REMOVED OR ABANDONED

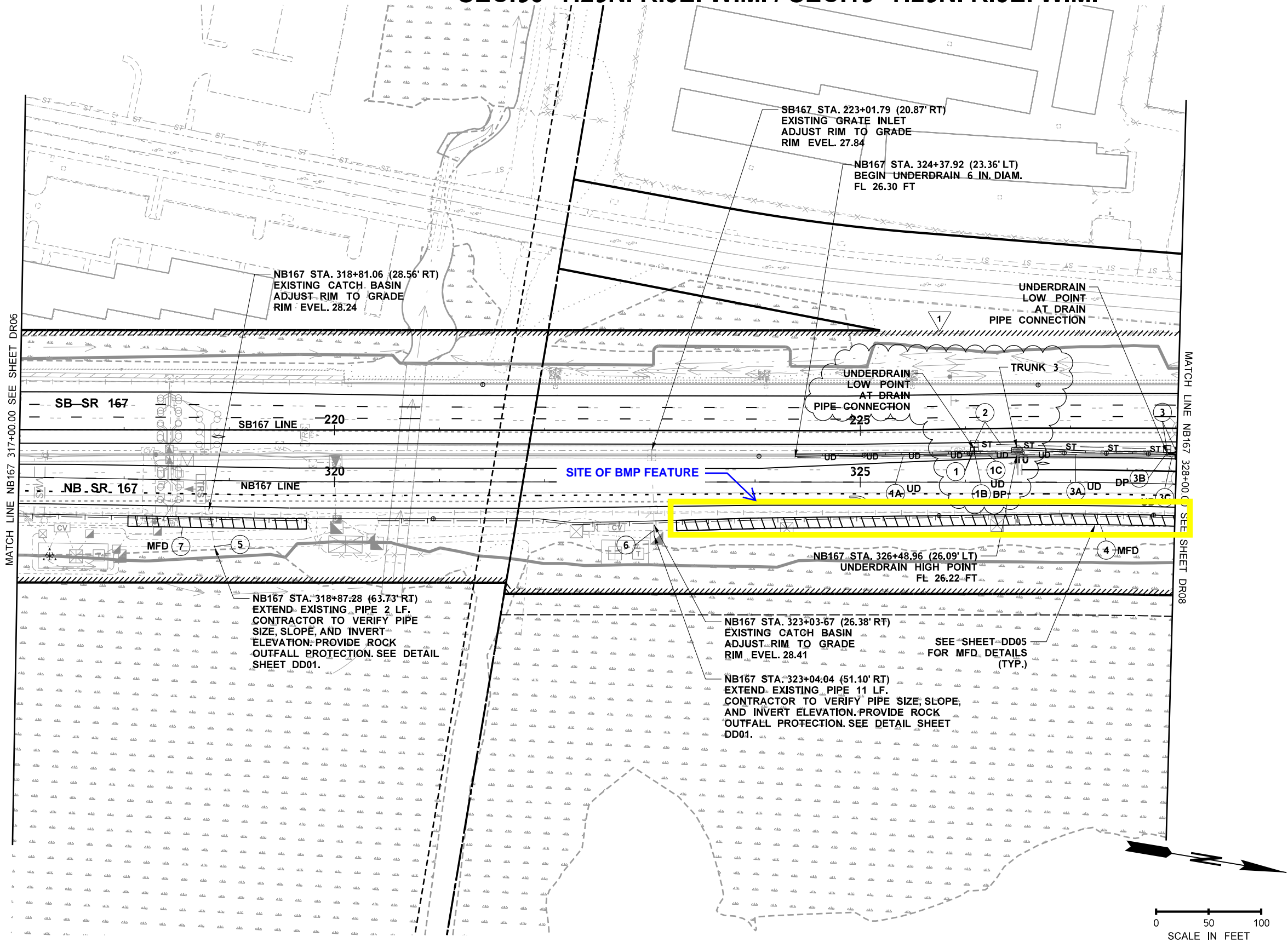







SEC.30 T.23N. R.5E. W.M. / SEC.19 T.23N. R.5E. W.M.

DRAINAGE REFERENCE SUMMARY		
DESCRIPTION	PROFILE/DETAIL SHEET(S)	
TRUNK 3	DP02	
DRAIN PIPE DR07-1B	DP50	
DRAIN PIPE DR07-3B	DP50	



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MAR 21 2018  
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






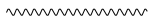
LEGEND	
①	- DRAINAGE STRUCTURE ID
DR01 ①	- DRAINAGE STRUCTURE ID CONTINUED
— ST — ST —	- STORM SEWER PIPE
— UD — UD —	- UNDERDRAIN PIPE
— DP — DP —	- DRAIN PIPE
□	- CATCH BASIN
▣	- GRATE INLET
▤	- DROP INLET
○	- MANHOLE
▣	- ROCK OUTFALL PROTECTION
→	- DRAINAGE DITCH
~	- COMPOST AMENDED BIOFILTRATION SWALE
▨	- MEDIA FILTER DRAIN
~~~~~	- EXISTING STORM TO BE REMOVED OR ABANDONED

FILE NAME c:\pwworking\atl_x_jzigweid\0321992\08811_PS_DR07.dgn										REGION NO. STATE 10 WASH		FED.AID PROJ.NO.			DATE 3/12/18	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E. STAMP BOX	DATE	P.E
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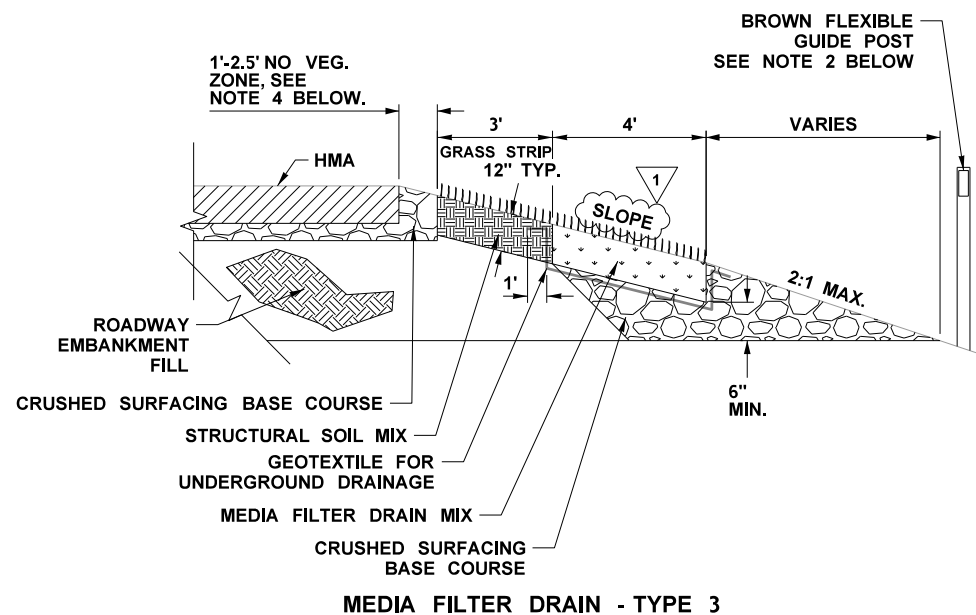
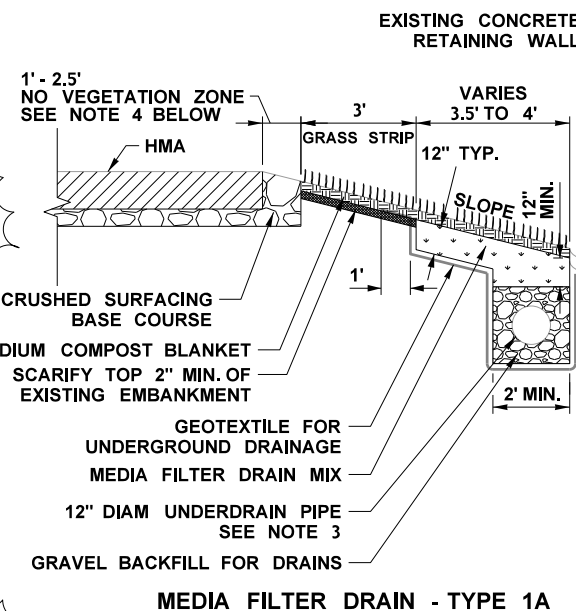
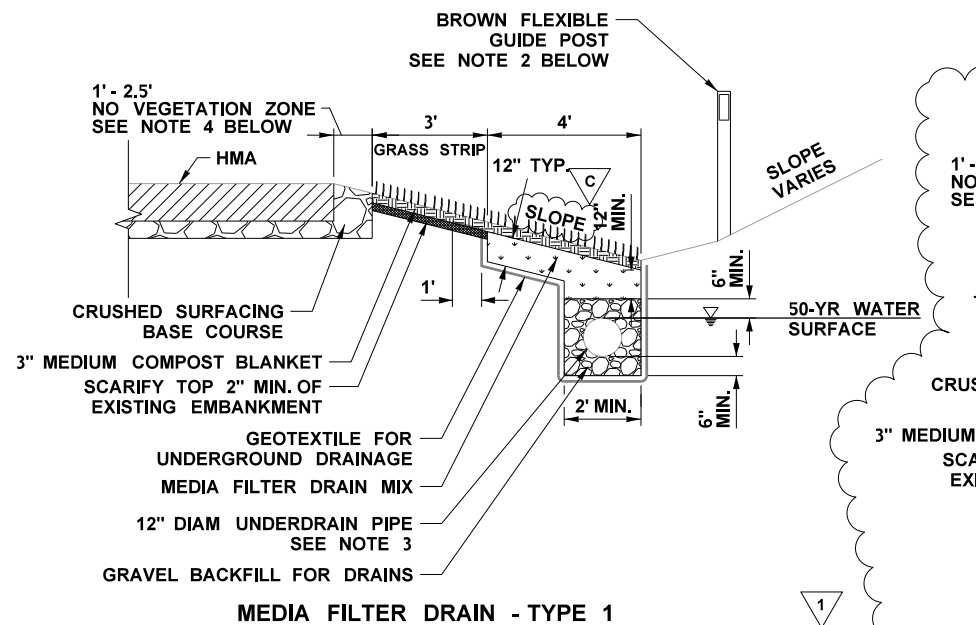
ATKINSON  
APR 13 2018  
RELEASED FOR CONSTRUCTION

### LEGEND

	- DRAINAGE STRUCTURE ID
	- DRAINAGE STRUCTURE ID CONTINUED
	- STORM SEWER PIPE
	- UNDERDRAIN PIPE
	- DRAIN PIPE
	- CATCH BASIN
	- GRATE INLET
	- DROP INLET
	- MANHOLE
	- ROCK OUTFALL PROTECTION
	- DRAINAGE DITCH
	- COMPOST AMENDED BIOFILTRATION SWALE
	- MEDIA FILTER DRAIN
	- EXISTING STORM TO BE REMOVED OR ABANDONED

[illegible]





### MEDIA FILTER DRAIN DETAILS N.T.S.

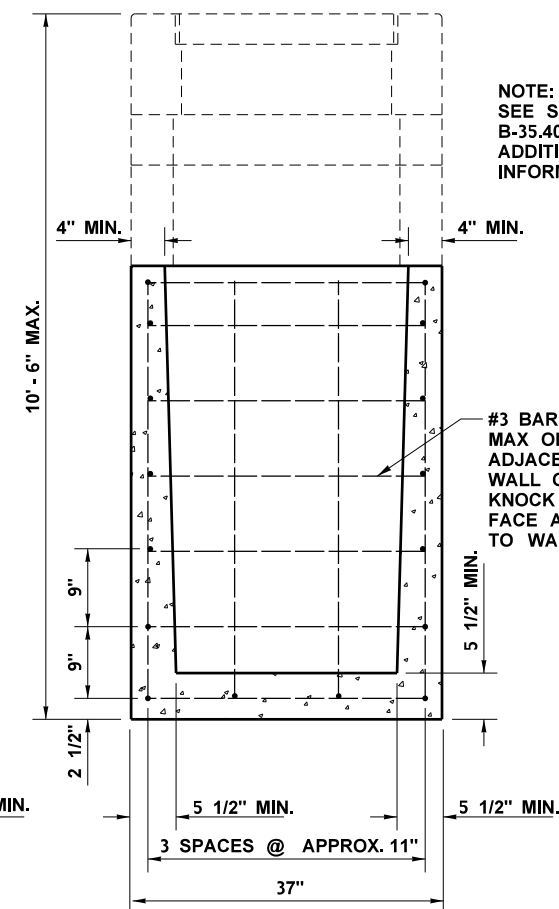
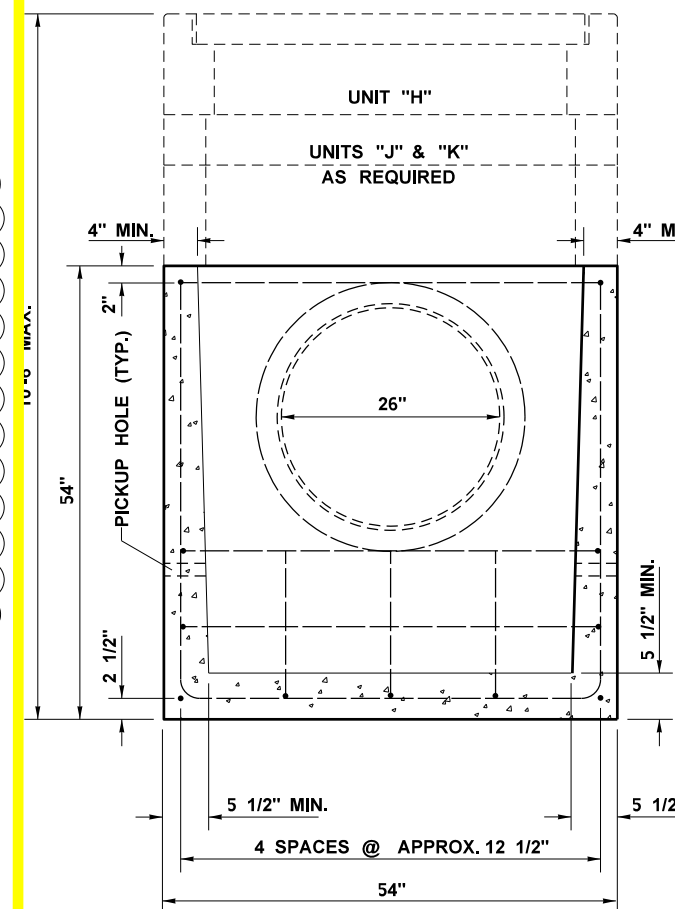
MEDIA FILTER DRAIN TABLE

STRUCTURE NOTE	START STATION	START OFFSET	END STATION	END OFFSET	LENGTH (LF)	SLOPE (H:V)	TYPE
DR07-4	NB167 323+25.26	36.42' RT	NB167 334+45.54	38.27' RT	1,120	4:1	3
DR07-7	NB167 318+04.40	35.00' RT	NB167 319+73.37	35.00' RT	169	4:1	3
DR13-31	SB405 1219+75.21	50.00' LT	SB405 1225+45.60	56.50' LT	570	4:1	1
DR13-31	SB405 1225+45.60	56.50' LT	SB405 1226+13.50	56.50' LT	68	6:1	1
DR14-11	SB405 1226+90.00	56.50' LT	SB405 1227+23.50	64.50' LT	34	6:1	1
DR14-11	SB405 1227+23.50	64.50' LT	SB405 1230+13.86	45.00' LT	290	6:1	1A

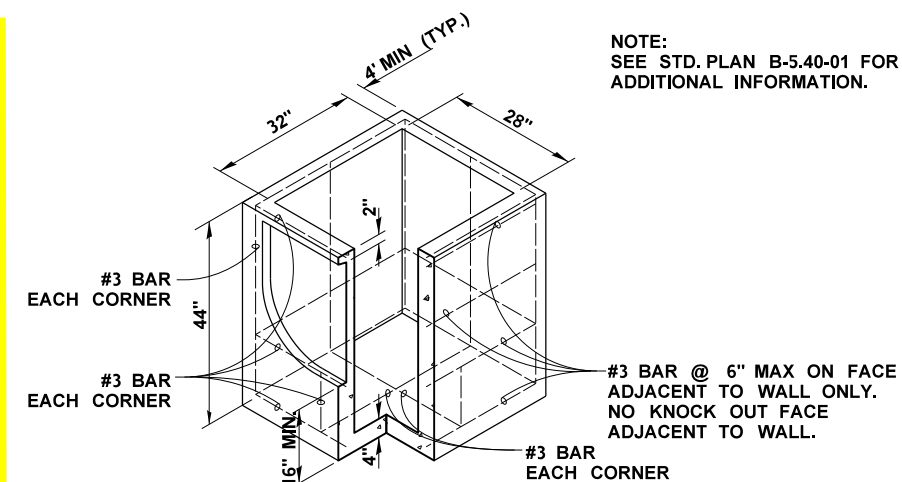
ATKINSON  
NOV 28 2017  
RELEASED FOR CONSTRUCTION

#### MFD NOTES:

- REFER TO ROADWAY SECTIONS FOR SIDE SLOPE GEOMETRY. WIDTH OF NO VEGETATION ZONE VARIES TO ACCOMMODATE GUARDRAIL INSTALLATIONS.
- INSTALL FLEXIBLE GUIDE POSTS (WITH NON-RELECTIVE SHEETING) AT THE BEGINNING AND END OF THE MEDIA FILTER DRAIN RUN AND ALONG THE LENGTH OF THE MEDIA FILTER DRAIN AT 500 FOOT SPACING (MAX). WHERE COINCIDENT WITH GUARDRAIL, GUIDE POST SHALL BE MOUNTED TO GUARDRAIL PER STD. PLAN M-40.10-03.
- PROVIDE A CLEANOUT AT THE UPSTREAM END OF THE UNDERDRAIN. THIS CLEANOUT MAY BE A 90° ELBOW EQUAL IN DIAMETER TO THE UNDERDRAIN WITH REMOVABLE CAP AT GRADE OR CATCH BASIN TYPE 1. PROVIDE CLEANOUTS AT 300' MAX. SPACING ALONG THE UNDERDRAIN AND AT JUNCTIONS. THESE CLEANOUTS MAY BE A TEE FITTING EQUAL IN DIAMETER TO THE UNDERDRAIN WITH REMOVABLE CAP AT GRADE OR CATCH BASIN TYPE 1.
- NO VEGETATION ZONE FOR MFD SHALL BE 1' EXCEPT AT GUARDRAILS IT SHALL BE 2.5'.
- SEE MEDIA FILTER DRAIN SPECIFICATION ON SHEET DD06.



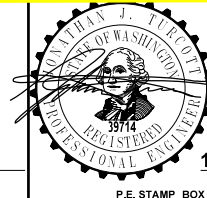
### CUSTOM GRATE INLET TYPE 2 ROTATED BASED ON STD. PLAN B-35.40-00 N.T.S.



NOTE:  
SEE STD. PLAN B-5.40-01 FOR  
ADDITIONAL INFORMATION.

TIME	3:45:35 PM					REGION NO.	STATE	FED.AID PROJ.NO.
DATE	11/27/2017					10	WASH	
PLOTTED BY	JZigweid	REV. 1 - RFC RFI0181	11/27/17					
DESIGNED BY	J. TURCOTT	REV. C - FINAL REVIEW	11/3/17					
ENTERED BY	E. JACKSON	REV. 0 - RFC	6/16/17					
CHECKED BY	J. ZIGWEID	REV. B - FINAL REVIEW	4/14/17					
PROJ. ENGR.	C. CHEN	REV. A - PRELIMINARY REVIEW	1/27/17					
REGIONAL ADM.	L. ENG	REVISION	DATE	BY		C8811		

P.E. STAMP BOX



P.E. STAMP BOX



I-405 / SR 167 INTERCHANGE  
DIRECT CONNECTOR

DRAINAGE DETAILS

PLAN REF NO  
DD05  
SHEET  
OF  
SHEETS



### DESCRIPTION

THIS WORK SHALL CONSIST OF CONSTRUCTING MEDIA FILTER DRAINS AND PLACING COMPOST.

## MATERIALS

MEDIUM COMPOST	9-14.4(8)
GEOTEXTILE FOR UNDERGROUND DRAINAGE	9-33

## MEDIA FILTER DRAIN

**MEDIA FILTER DRAIN MIX**

**AGGREGATE FOR MEDIA FILTER DRAIN MIX**

HORT|CULTURAL GRADE PERLITE

SIEVE SIZE	% PASSING
NO. 4	99% - 100%
NO. 18	0% - 30%
NO. 30	0% - 10%

**AGRICULTURAL GRADE DOLOMITE****AGRICULTURAL GRADE GYPSUM**

SIEVE SIZE	% PASSING
1/4-INCH	99% - 100%
NO. 20	0% - 20%

## STRUCTURAL SOIL MIX

## COMPOST

## AGGREGATE

## MIXING REQUIREMENTS

STRUCTURAL SOIL MIX SHALL BE THOROUGHLY MIXED PRIOR TO BEING PLACED.

## CONSTRUCTION REQUIREMENTS

## MEDIA FILTER DRAIN

ONCE INSTALLED, THE CONTRACTOR WILL NOT BE ALLOWED TO DRIVE EQUIPMENT OVER THE AREA OF THE MEDIA FILTER DRAIN.

THE CONTRACTOR SHALL PLACE THE STRUCTURAL SOIL MIX IN LAYERS NO MORE THAN 5-INCHES IN DEPTH BEFORE COMPACTION. EACH LAYER SHALL BE COMPACTED BY THREE PASSES OF A VIBRATORY PLATE COMPACTOR. AFTER PLACEMENT AND COMPACTION OF STRUCTURAL SOIL MIX, MEDIUM COMPOST SHALL BE PLACED TO A DEPTH OF TWO INCHES PRIOR TO SEEDING, FERTILIZING AND MULCHING.

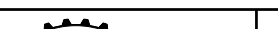


**NOTE:**

**NOTE:**  
ALL PARTS MUST BE EITHER ALUMINUM OR STAINLESS  
STEEL. NO GALVANIZED MATERIAL TO BE USED.

**N.T.S.**

FILE NAME		c:\pwworking\nal_x_ejackson\d0321992\C8811_DE_DD06.dgn											
TIME		12:35:40 PM						REGION NO.		STATE		FED.AID PROJ.NO.	
DATE		6/8/2017						10		WASH			
PLOTTED BY		EJackson										JOB NUMBER	
DESIGNED BY		J. TURCOTT											
ENTERED BY		E. JACKSON		REV. 0 - RFC		6/16/17						CONTRACT NO.	
CHECKED BY		J. ZIGWEID		REV. B - FINAL REVIEW		4/14/17							
PROJ. ENGR.		C. CHEN		REV. A - PRELIMINARY REVIEW		01/27/17						C8811	
REGIONAL ADM.		L. ENG		REVISION		DATE		BY					

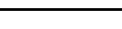


P.E. STAMP BOX

DATE

P.E. STAMP BOX

DATE



Washington State  
Department of Transportation

P.E. STAMP BOX

DATE

I-405 / SR 167 INTERCHANGE  
DIRECT CONNECTOR

DRAINAGE DETAILS

PLAN REF NO

DD06

SHEET

OF

SHEETS





SITE INFORMATION	
LOCATION:	SR 167 MP 25.6
FACILITY TYPE:	MEDIA FILTER DRAIN
MAINTENANCE RESPONSIBILITY:	WSDOT
DESIGN:	OL-XXXX   CONSTRUCTION: 01XXXX   JOB NUMBER: XXXX
HYDRAULIC REPORT	TBD
MODIFIED BY:	N/A
SITE DESCRIPTION:	THIS IS A 169 LF MEDIA FILTER DRAIN PROVIDING ENHANCED WATER QUALITY.
AS-BUILT FIELD VERIFICATION:	N/A
SURVEY BENCH MARK:	TBD
FEATURE ANOMALIES:	N/A
DISCLAIMER:	NOTIFY MAINTENANCE SUPERVISOR IF THE BMP IS NOT CHARACTERISTIC OF THIS OWNER'S MANUAL TO FACILITATE MAINTENANCE ACTIVITIES. CONTACT MAINTENANCE SUPERINTENDENT BEFORE ANY MAINTENANCE TAKES PLACE.
DIRECTIONS:	







**FEATURE #: WSDOT####**





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**SHEET 2 OF 6**

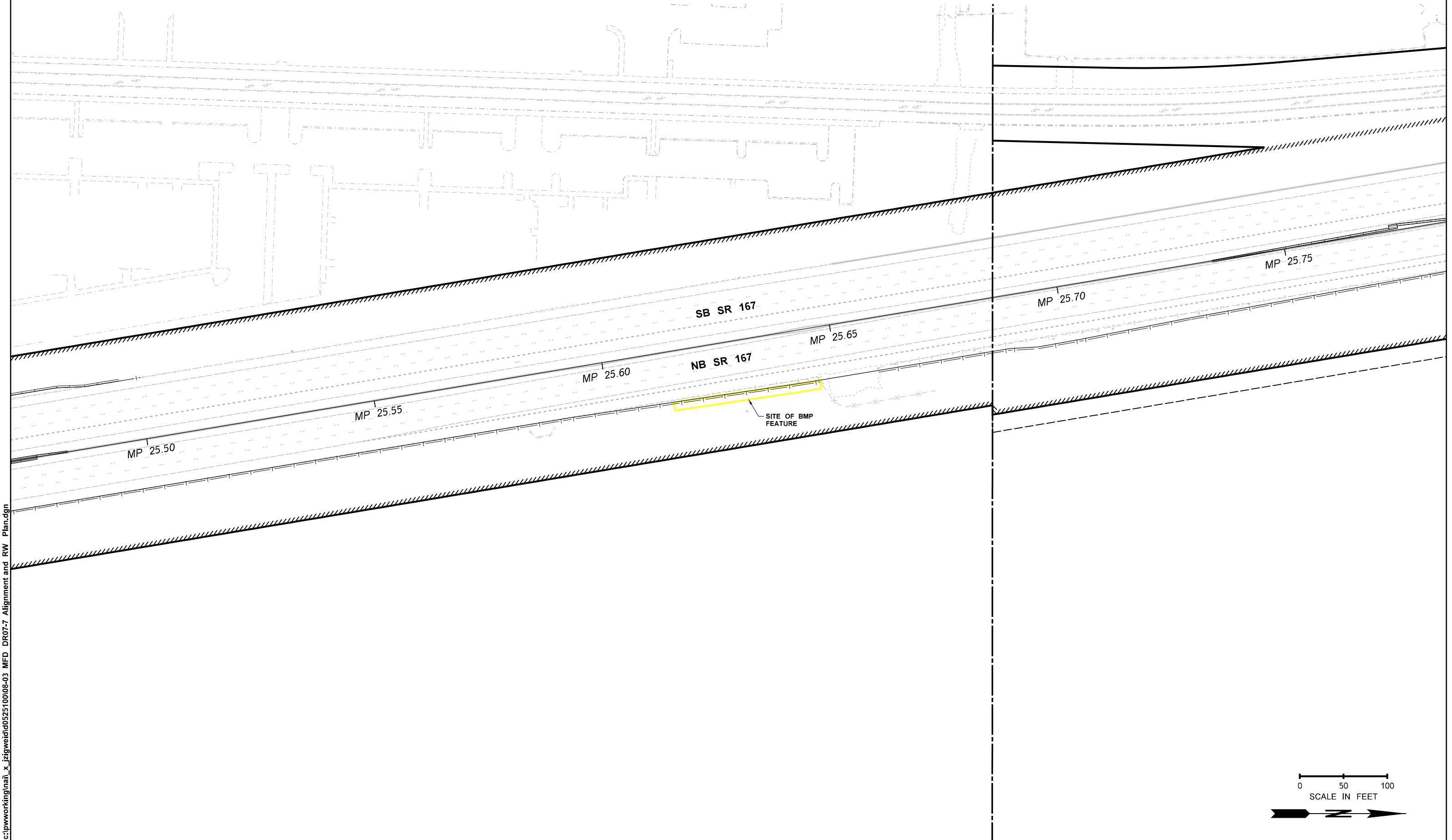


NO.	ITEM	BMP MAINTENANCE ACTIVITY
NOTE: THE FOLLOWING ITEMS SUPPLEMENT HRM TABLES 5-12 THROUGH 5-24. REFER TO TABLES 5-12 THROUGH 5-24 FOR GENERAL MAINTENANCE ACTIVITIES.		
1	NON-VEGETATION ZONE	REMOVE ALL VEGETATION FROM NON-VEGETATION ZONE.
2	GRASS STRIP	REFER TO HRM TABLES 5-12 THROUGH 5-24.
3	MEDIA FILTER DRAIN MIX	REFER TO HRM TABLES 5-12 THROUGH 5-24.

NO.	ITEM	BMP MAINTENANCE ACTIVITY
NOTE: THE FOLLOWING ITEMS SUPPLEMENT HRM TABLES 5-12 THROUGH 5-24. REFER TO TABLES 5-12 THROUGH 5-24 FOR GENERAL MAINTENANCE ACTIVITIES.		
1	NON-VEGETATION ZONE	REMOVE ALL VEGETATION FROM NON-VEGETATION ZONE.
2	GRASS STRIP	REFER TO HRM TABLES 5-12 THROUGH 5-24.
3	MEDIA FILTER DRAIN MIX	REFER TO HRM TABLES 5-12 THROUGH 5-24.

<b>LEGEND</b>	
	- DRAINAGE STRUCTURE ID CONTINUED
— ST — ST —	- STORM SEWER PIPE
	- CATCH BASIN
	- MEDIA FILTER DRAIN
	- EXISTING STORM TO BE REMOVED OR ABANDONED

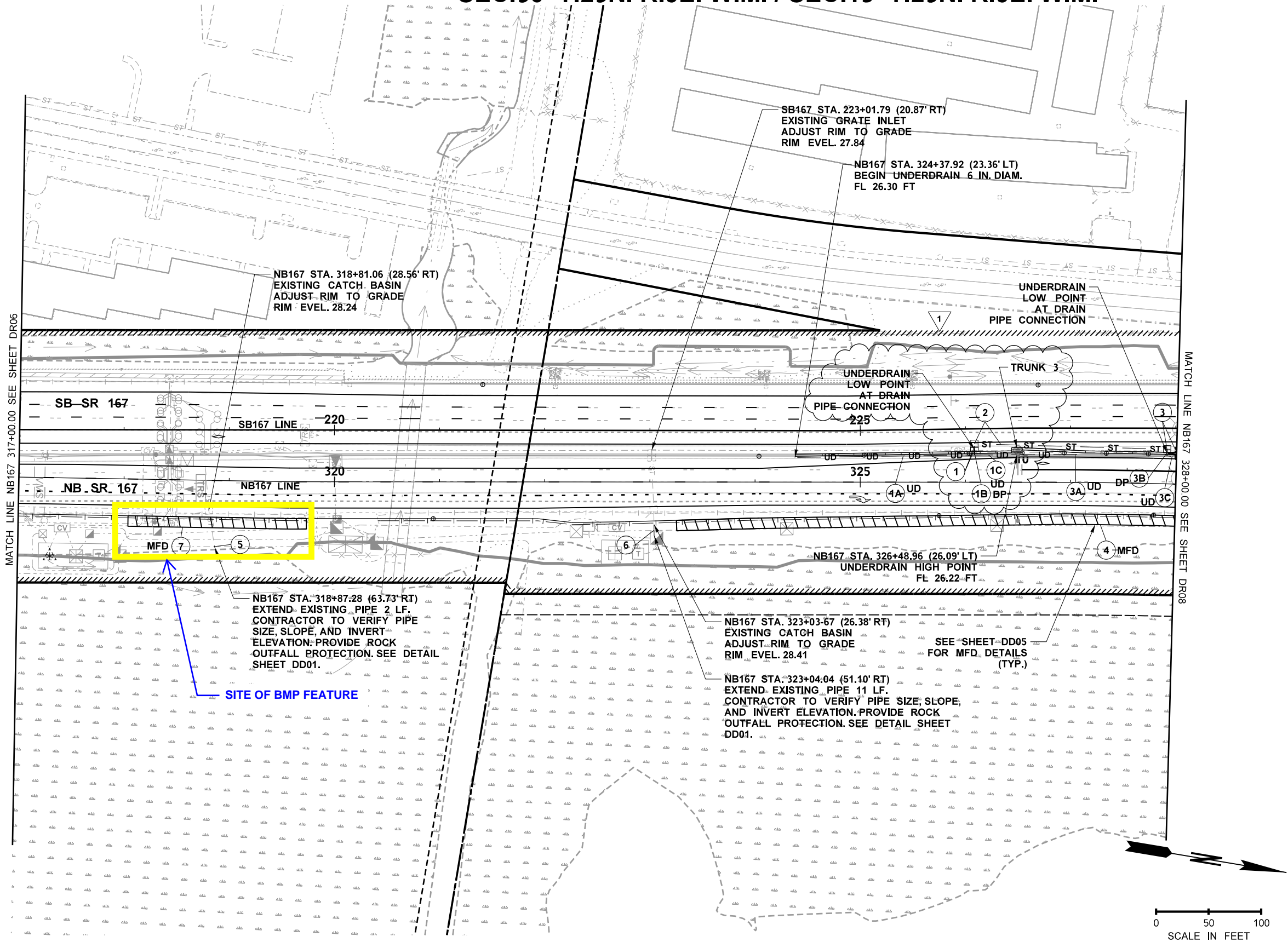






SEC.30 T.23N. R.5E. W.M. / SEC.19 T.23N. R.5E. W.M.

DRAINAGE REFERENCE SUMMARY	
DESCRIPTION	PROFILE/DETAIL SHEET(S)
TRUNK 3	DP02
DRAIN PIPE DR07-1B	DP50
DRAIN PIPE DR07-3B	DP50





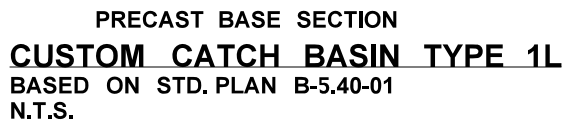
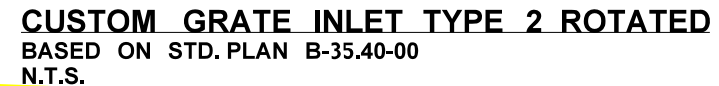


### MEDIA FILTER DRAIN TABLE

1

RELEASED FOR CONSTRUCTION

1

[illegible]



MEDIA FILTER DRAIN SPECIFICATION

DESCRIPTION

SECTION 7-01.1 IS SUPPLEMENTED WITH THE FOLLOWING:

THIS WORK SHALL CONSIST OF CONSTRUCTING MEDIA FILTER DRAINS AND PLACING COMPOST.

REFER TO SHEET DD05 FOR TYPICAL MEDIA FILTER DRAIN CONFIGURATIONS.

MATERIALS

SECTION 7-01.2 IS SUPPLEMENTED WITH THE FOLLOWING:

MEDIUM COMPOST 9-14.4(8)  
GEOTEXTILE FOR UNDERGROUND DRAINAGE 9-33

MEDIA FILTER DRAIN

MEDIA FILTER DRAIN MIX

MEDIA FILTER DRAIN MIX SHALL BE MIXED IN THE FOLLOWING PROPORTIONS: 3 CUBIC YARDS OF AGGREGATE, 1 CUBIC YARD OF HORTICULTURAL GRADE PERLITE, 40 POUNDS OF AGRICULTURAL GRADE DOLOMITE, AND 12 POUNDS OF AGRICULTURAL GRADE GYPSUM. MEDIA FILTER DRAIN MIX SHALL BE PREMIXED PRIOR TO PLACEMENT. THE SOIL AMENDMENTS AND AGGREGATE SHALL MEET THE FOLLOWING REQUIREMENTS PRIOR TO MIXING:

AGGREGATE FOR MEDIA FILTER DRAIN MIX

AGGREGATE FOR MEDIA FILTER DRAIN MIX SHALL MEET ALL REQUIREMENTS FOR SECTION 9-03.4 AGGREGATE FOR BITUMINOUS SURFACE TREATMENT - CRUSHED SCREENINGS 3/8-INCH TO NO. 4 EXCEPT THE FRACTURE REQUIREMENT SHALL BE AT LEAST TWO FRACTURED FACES AND WILL APPLY TO MATERIAL RETAINED ON THE U.S. NO. 4 SIEVE IN ACCORDANCE WITH FOP FOR AASHTO T 335.

HORTICULTURAL GRADE PERLITE

HORTICULTURAL GRADE PERLITE SHALL BE PER SECTION 9-14.4(9), MEET THE FOLLOWING GRADING REQUIREMENTS, AND NOT CONTAIN ANY TOXIC MATERIAL:

SIEVE SIZE	% PASSING
NO. 4	99% - 100%
NO. 18	0% - 30%
NO. 30	0% - 10%

AGRICULTURAL GRADE DOLOMITE

AGRICULTURAL GRADE DOLOMITE SHALL BE PER SECTION 9-14.4(5) AND MEET THE REQUIREMENTS OF ASTM C 602 CLASS DESIGNATION E.

AGRICULTURAL GRADE GYPSUM

AGRICULTURAL GRADE GYPSUM SHALL BE PER SECTION 9-14.4(6) AND MEET THE FOLLOWING GRADING REQUIREMENTS:

SIEVE SIZE	% PASSING
1/4-INCH	99% - 100%
NO. 20	0% - 20%

THE ACCEPTANCE OF THE AGGREGATE SHALL BE BASED ON A SATISFACTORY TEST REPORT FOR EVERY 1000 TONS. TESTING OF AGGREGATE SHALL OCCUR PRIOR TO MIXING WITH THE SOIL AMENDMENTS. HORTICULTURAL GRADE PERLITE, AGRICULTURAL GRADE DOLOMITE AND GYPSUM WILL BE ACCEPTED BY CATALOG CUT OR BAG LABEL.

THE FINISHED PRODUCT SHALL BE CLEAN, UNIFORMLY MIXED, AND FREE FROM WOOD, BARK, ROOTS, AND OTHER DELETERIOUS MATERIALS.

STRUCTURAL SOIL MIX

THE STRUCTURAL SOIL MIX FOR THE GRASS STRIP SHALL CONSIST OF A UNIFORM BLEND COMPOSED BY VOLUME OF 70% TO 80% AGGREGATE, 20% TO 30% COMPOST. 100% OF THE MIXTURE SHALL PASS THROUGH A 2-1/2 INCH SIEVE.

COMPOST

COMPOST SHALL BE MEDIUM COMPOST AND MEET THE MATERIAL REQUIREMENTS AS SPECIFIED IN SECTION 9-14.4(8).

AGGREGATE

AGGREGATE SHALL CONSIST OF BALLAST IN ACCORDANCE WITH SECTION 9-03.9(1).

MIXING REQUIREMENTS

THE CONTRACTOR SHALL SUBMIT THE PROPOSED METHOD OF MIXING IN WRITING FOR THE ENGINEER'S APPROVAL. NO MIXING SHALL TAKE PLACE WITHOUT WRITTEN APPROVAL FROM THE ENGINEER.

STRUCTURAL SOIL MIX SHALL BE THOROUGHLY MIXED PRIOR TO BEING PLACED.

CONSTRUCTION REQUIREMENTS

SECTION 7-01.3 IS SUPPLEMENTED WITH THE FOLLOWING:

MEDIA FILTER DRAIN

THE CONTRACTOR SHALL CONSTRUCT THE MEDIA FILTER DRAIN IN ACCORDANCE WITH THE DETAILS IN THE PLANS.

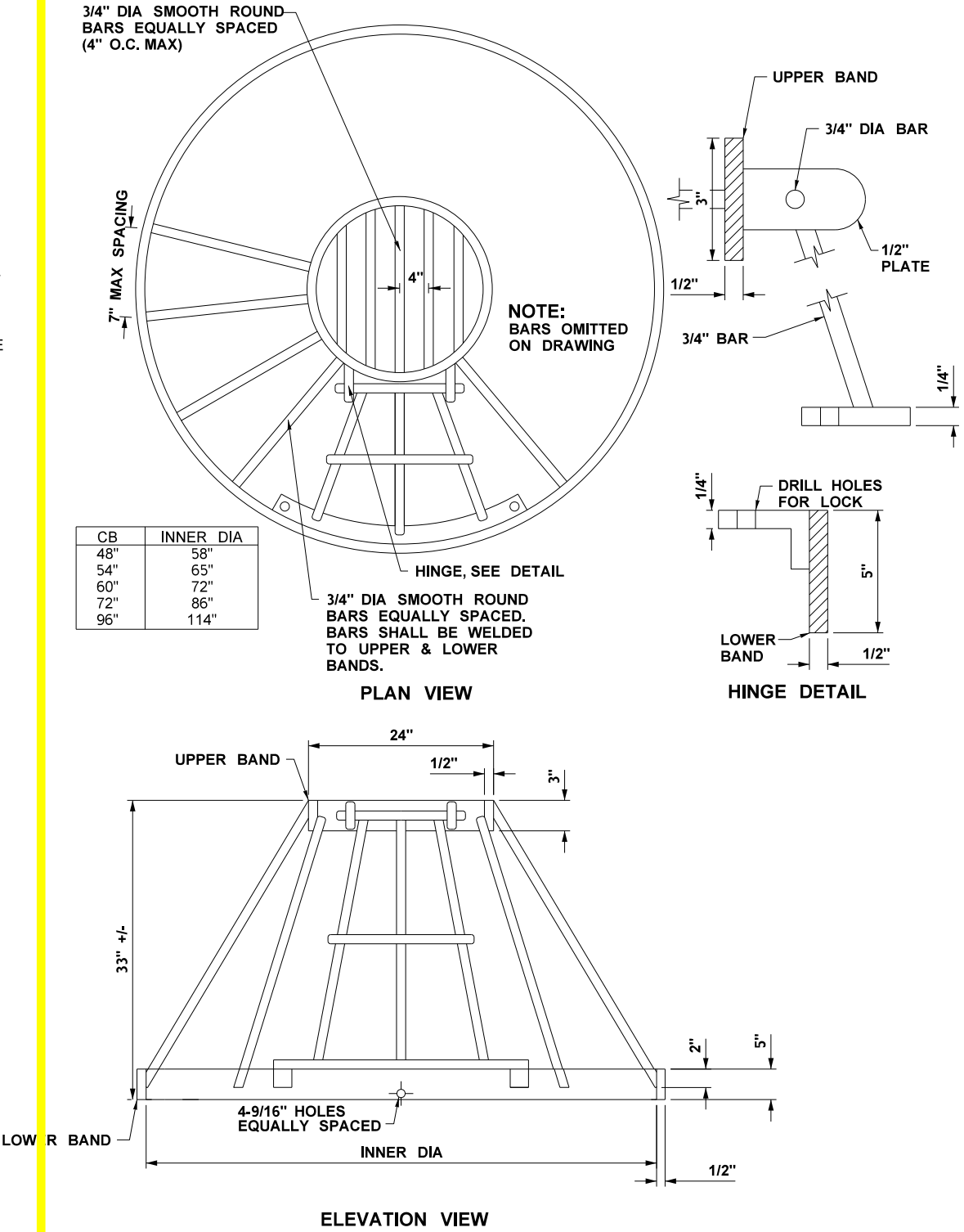
THE CONTRACTOR SHALL CONDUCT THE INSTALLATION OF THE MEDIA FILTER DRAIN SUCH THAT THE DIFFERENT SECTIONS OF THE MEDIA FILTER DRAIN ARE NOT CONTAMINATED OR DISPLACED BY OTHER MATERIALS DURING INSTALLATION.

THE CONTRACTOR SHALL NOT SEED, FERTILIZE OR MULCH THE MEDIA FILTER DRAIN MIX.

ONCE INSTALLED, THE CONTRACTOR WILL NOT BE ALLOWED TO DRIVE EQUIPMENT OVER THE AREA OF THE MEDIA FILTER DRAIN.

MEDIA FILTER DRAIN EXCAVATION SHALL CONFORM TO SECTION 2-09.3(4). EXCAVATED MATERIAL SUITABLE FOR USE IN EMBANKMENT MAY BE USED AT THE DISCRETION OF THE ENGINEER. OTHERWISE, THE MATERIAL EXCAVATED SHALL BECOME PROPERTY OF THE CONTRACTOR.

THE CONTRACTOR SHALL PLACE THE STRUCTURAL SOIL MIX IN LAYERS NO MORE THAN 5-INCHES IN DEPTH BEFORE COMPACTION. EACH LAYER SHALL BE COMPACTED BY THREE PASSES OF A VIBRATORY PLATE COMPACTOR. AFTER PLACEMENT AND COMPACTION OF STRUCTURAL SOIL MIX, MEDIUM COMPOST SHALL BE PLACED TO A DEPTH OF TWO INCHES PRIOR TO SEEDING, FERTILIZING AND MULCHING.



NOTE:  
ALL PARTS MUST BE EITHER ALUMINUM OR STAINLESS STEEL. NO GALVANIZED MATERIAL TO BE USED.

DEBRIS CAGE

N.T.S.

FILE NAME 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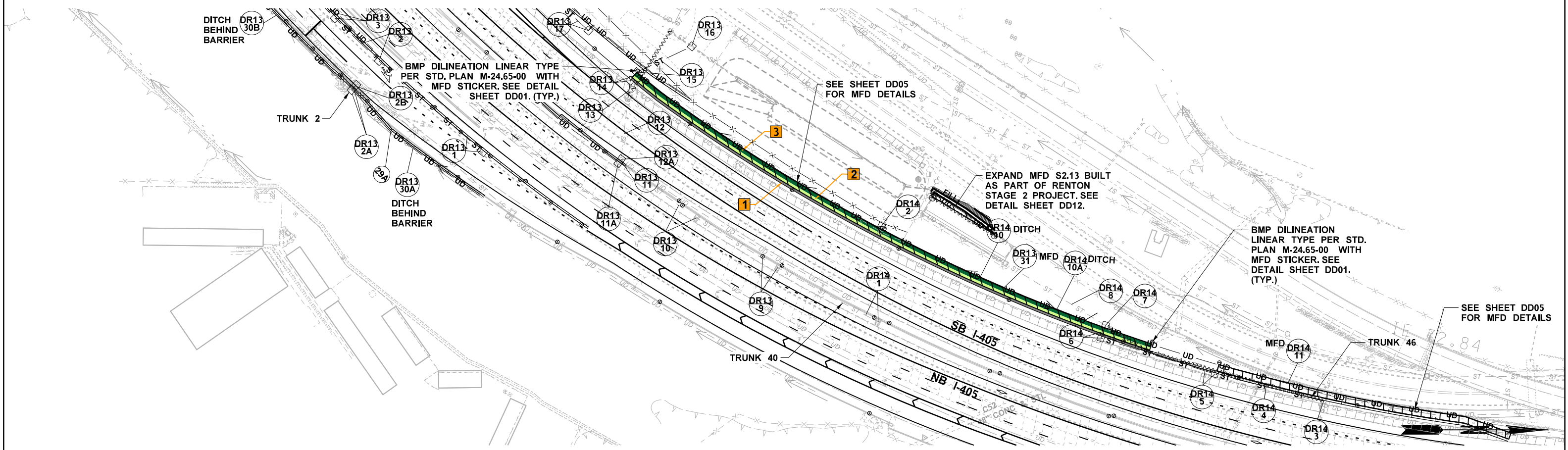
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VICINITY MAP







NO.	ITEM	PURPOSE
1	NON-VEGETATION ZONE	ENSURES DISPERSION AND PROVIDES SOME POLLUTANT TRAPPING.
2	GRASS STRIP	PROVIDES PRETREATMENT AND SEDIMENT REMOVAL.
3	MEDIA FILTER DRAIN MIX	PROVIDE ENHANCED WATER QUALITY TREATMENT.

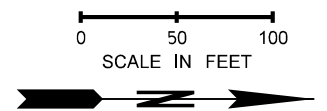
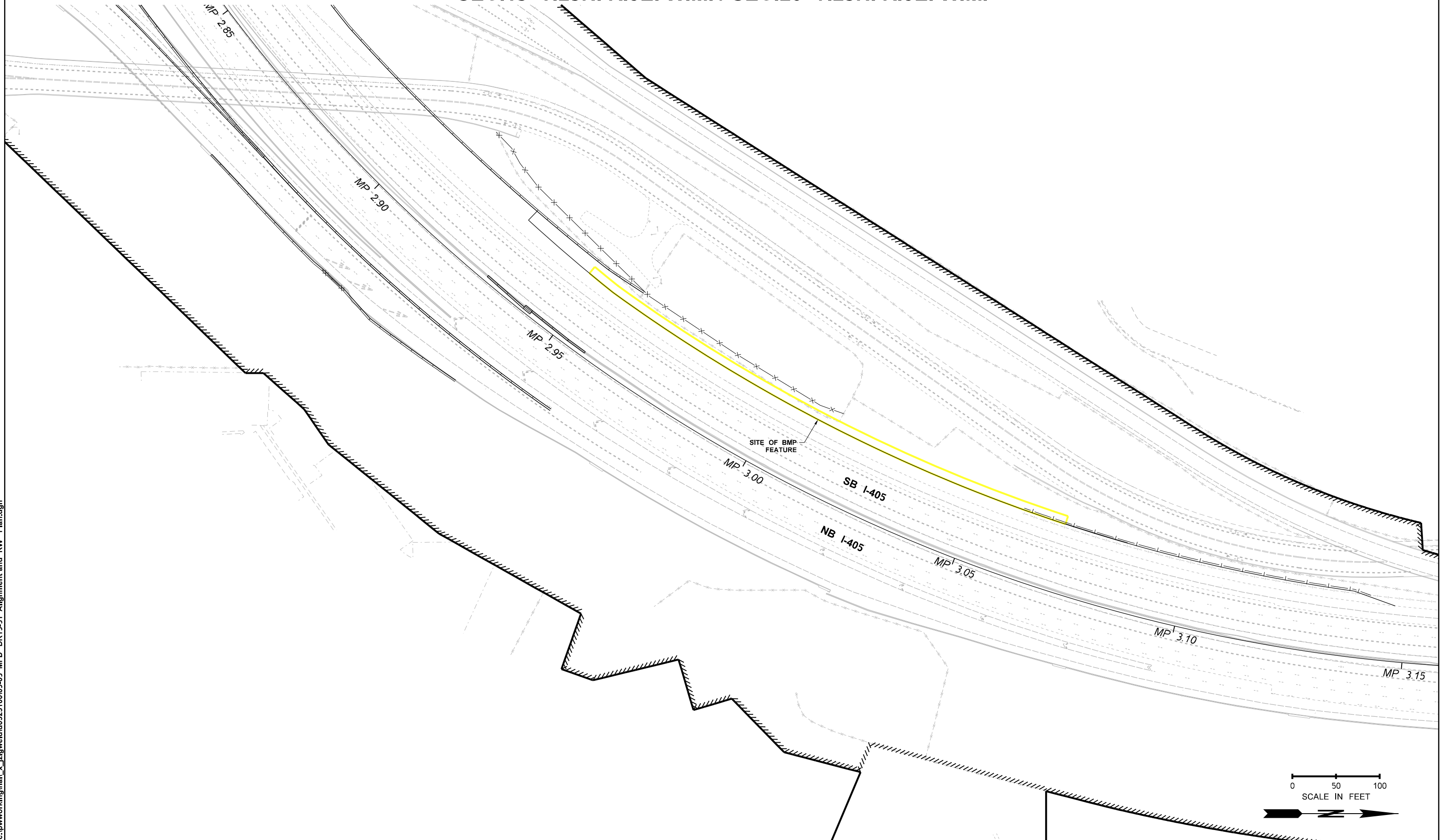
NO.	ITEM	BMP MAINTENANCE ACTIVITY
NOTE: THE FOLLOWING ITEMS SUPPLEMENT HRM TABLES 5-12 THROUGH 5-24. REFER TO TABLES 5-12 THROUGH 5-24 FOR GENERAL MAINTENANCE ACTIVITIES.		
1	NON-VEGETATION ZONE	REMOVE ALL VEGETATION FROM NON-VEGETATION ZONE.
2	GRASS STRIP	REFER TO HRM TABLES 5-12 THROUGH 5-24.
3	MEDIA FILTER DRAIN MIX	REFER TO HRM TABLES 5-12 THROUGH 5-24.

LEGEND	
	- DRAINAGE STRUCTURE ID CONTINUED
	- STORM SEWER PIPE
	- CATCH BASIN
	- ROCK OUTFALL PROTECTION
	- MEDIA FILTER DRAIN
	- EXISTING STORM TO BE REMOVED OR ABANDONED

c:\pwworking\atl\_x\_jzgweid\05251009-02 MFD DR13-31 Maintenance Plan.dgn

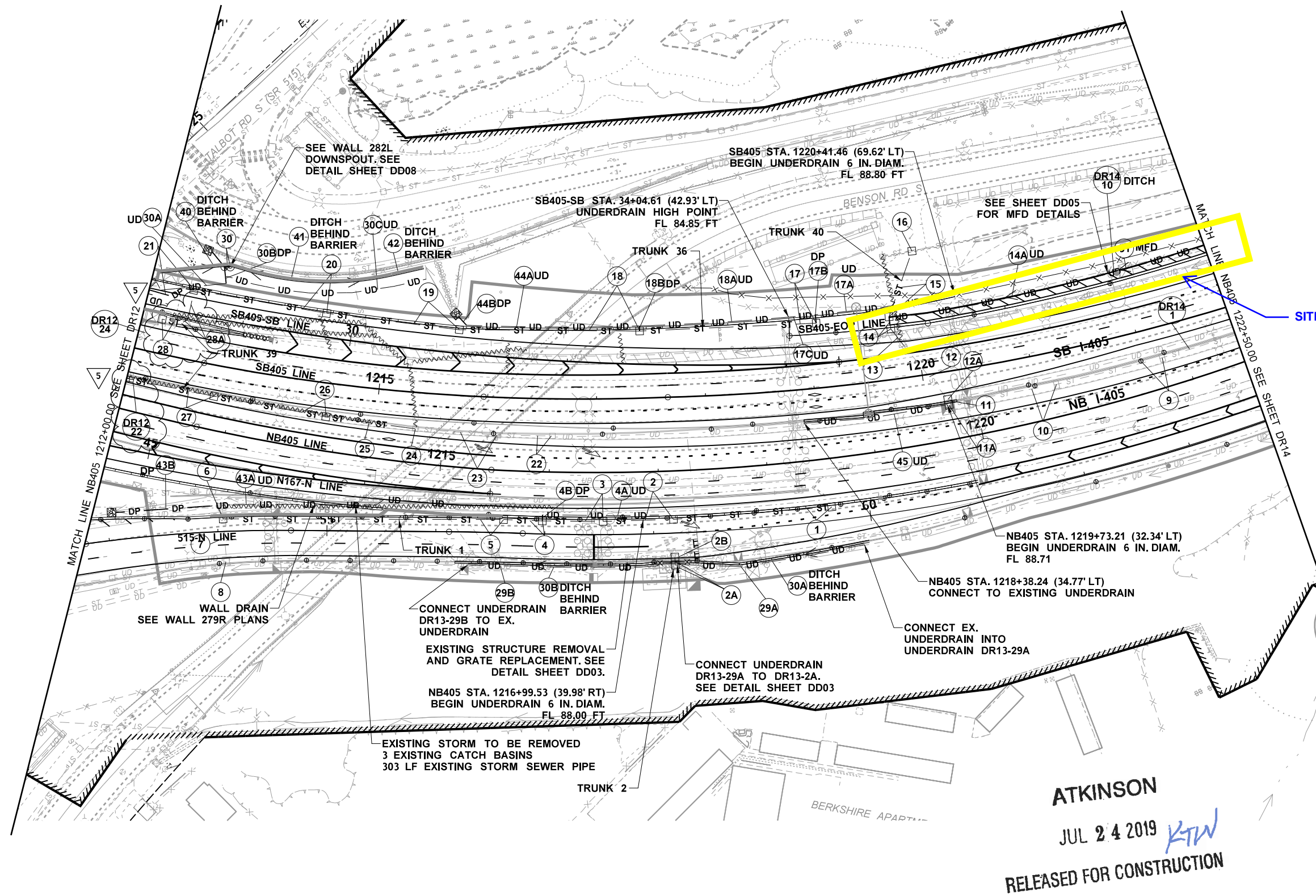


SEC.19 T.23N. R.5E. W.M. / SEC.20 T.23N. R.5E. W.M.





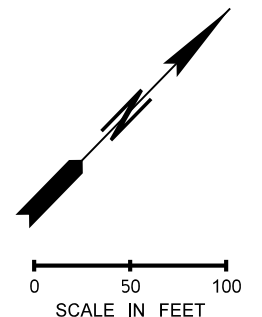
**SEC.19 T.23N. R.5E. W.M. / SEC.20 T.23N. R.5E. W.M.**
















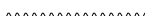
DRAINAGE REFERENCE SUMMARY		
DESCRIPTION	PROFILE/DETAIL	SHEET(S)
TRUNK 1		DP01
TRUNK 2		DP01
TRUNK 36		DP18
TRUNK 39		DP20
TRUNK 40		DP21
DRAIN PIPE DR13-17B		DP55
DRAIN PIPE DR13-18B		DP55
DRAIN PIPE DR13-43B		DP50
DRAIN PIPE DR13-44B		DP55
DRAIN PIPE DR13-4B		DP56


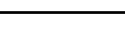
NOTE:

1. SEE DRAINAGE PLAN  
ENLARGEMENTS SHEETS DD30-DD33.



## LEGEND

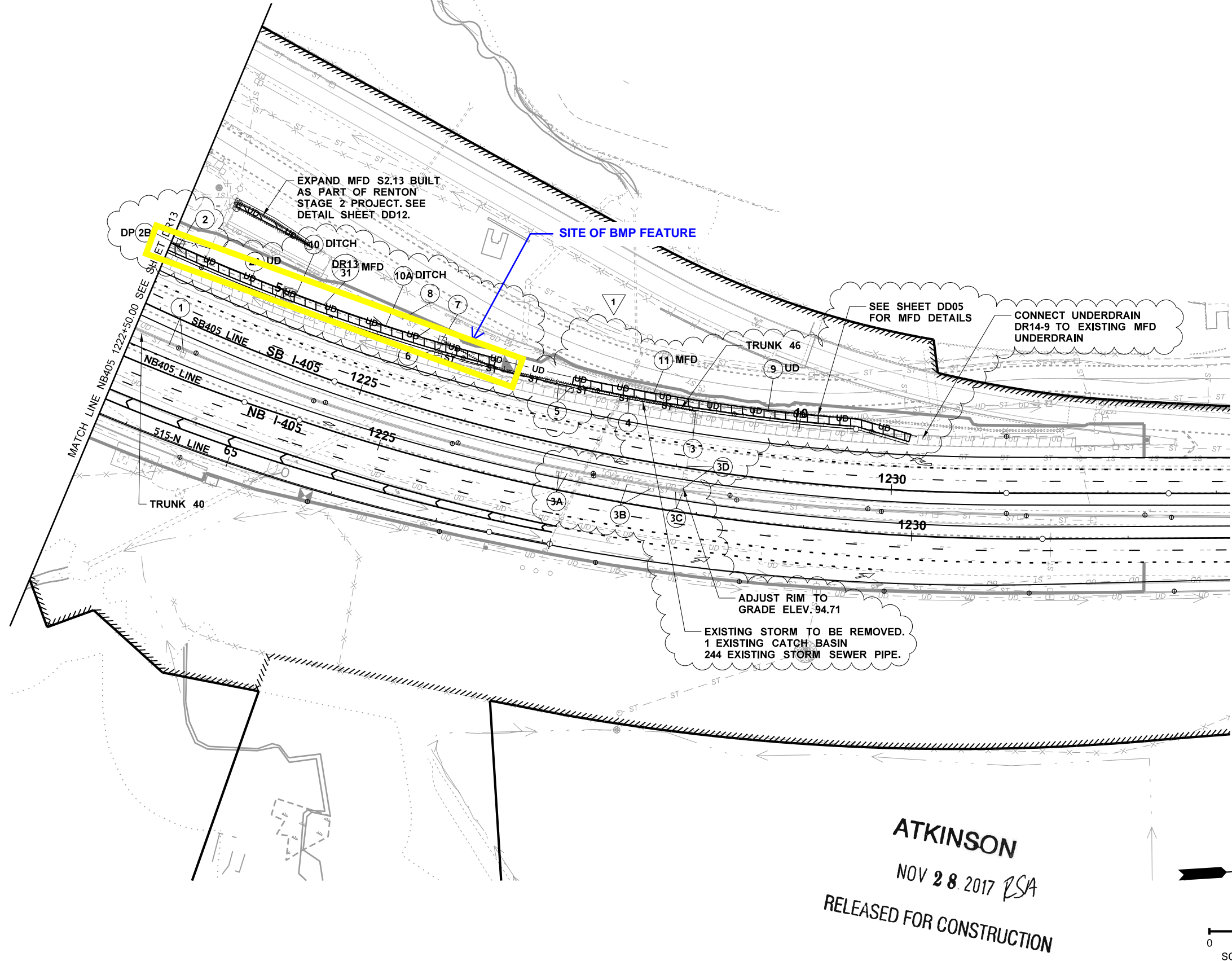
	- DRAINAGE STRUCTURE ID
	- DRAINAGE STRUCTURE ID CONTINUED
	- STORM SEWER PIPE
	- UNDERDRAIN PIPE
	- DRAIN PIPE
	- CATCH BASIN
	- GRATE INLET
	- DROP INLET
	- MANHOLE
	- ROCK OUTFALL PROTECTION
	- DRAINAGE DITCH
	- COMPOST AMENDED BIOFILTRATION SWALE
	- MEDIA FILTER DRAIN
	- EXISTING STORM TO BE REMOVED OR ABANDONED

FILE NAME c:\pwworking\inal_x_jzigweid\d0321992\C8811_PS_DR13.dgn																																								PLAN REF NO																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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SEC.20 T.23N. R.5E. W.M. / SEC.17 T.23N. R.5E. W.M.



DRAINAGE REFERENCE SUMMARY	
DESCRIPTION	PROFILE/DETAIL SHEET(S)
TRUNK 40	DP21
TRUNK 46	DP24
DRAIN PIPE DR14-2B	DP56



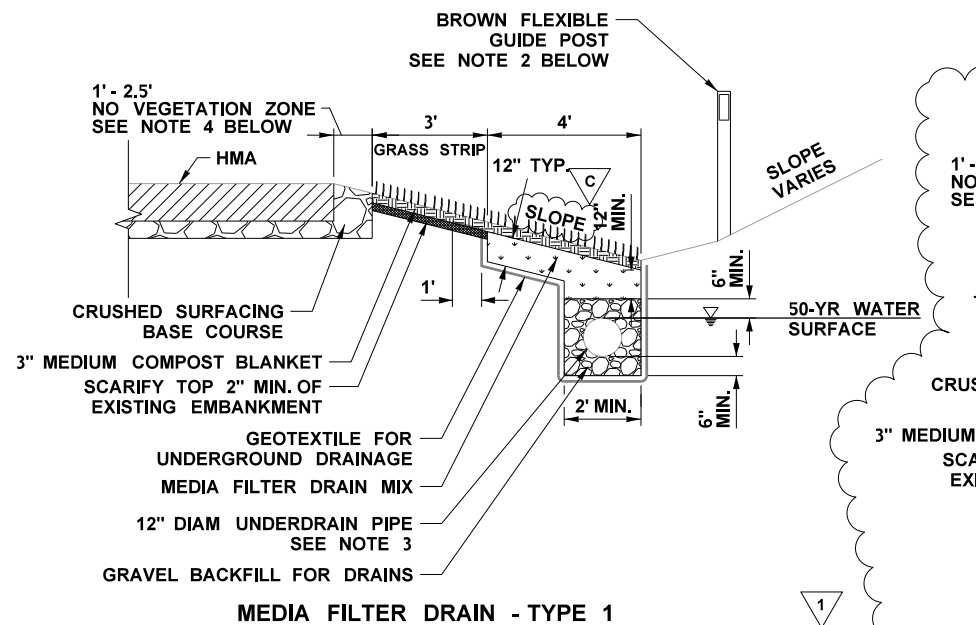
LEGEND	
①	- DRAINAGE STRUCTURE ID
DR01 1	- DRAINAGE STRUCTURE ID CONTINUED
— ST — ST —	- STORM SEWER PIPE
— UD — UD —	- UNDERDRAIN PIPE
— DP — DP —	- DRAIN PIPE
□	- CATCH BASIN
▣	- GRATE INLET
▤	- DROP INLET
○	- MANHOLE
▣	- ROCK OUTFALL PROTECTION
→	- DRAINAGE DITCH
~	- COMPOST AMENDED BIOFILTRATION SWALE
▨	- MEDIA FILTER DRAIN
~~~~~	- EXISTING STORM TO BE REMOVED OR ABANDONED

ATKINSON  
NOV 28 2017 *PSA*  
RELEASED FOR CONSTRUCTION

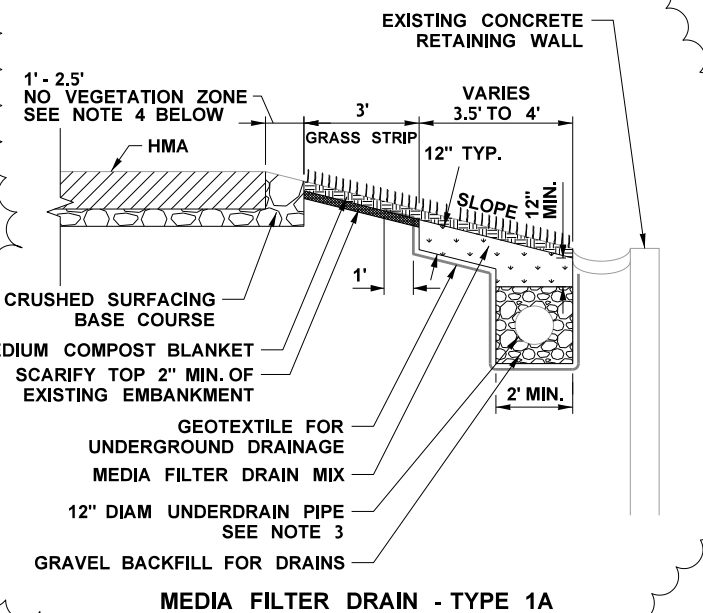
0 50 100  
SCALE IN FEET

FILE NAME c:\pwworking\nai_x_jzigweid\0321992\0321992\PS_DR14.dgn												 Washington State Department of Transportation		I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR		PLAN REF NO	
TIME 3:35:30 PM								DR14									
DATE 11/27/2017						REGION NO. 10		STATE WASH		FED.AID PROJ.NO.						SHEET	
PLOTTED BY JZigweid		REV. 1 - RFC RFI0181		11/27/17													
DESIGNED BY J. TURCOTT		REV. C - FINAL REVIEW		11/3/17		JOB NUMBER				LOCATION NO.						OF	
ENTERED BY E. JACKSON		REV. 0 - RFC		6/16/17													
CHECKED BY J. ZIGWEID		REV. B - FINAL REVIEW		4/14/17		CONTRACT NO.				11/27/17		DATE				P.E. STAMP BOX	
PROJ. ENGR. C. CHEN		REV. A - PRELIMINARY REVIEW		1/27/17													
REGIONAL ADM. L. ENG		REVISION		DATE		BY		C8811								DRAINAGE PLAN	

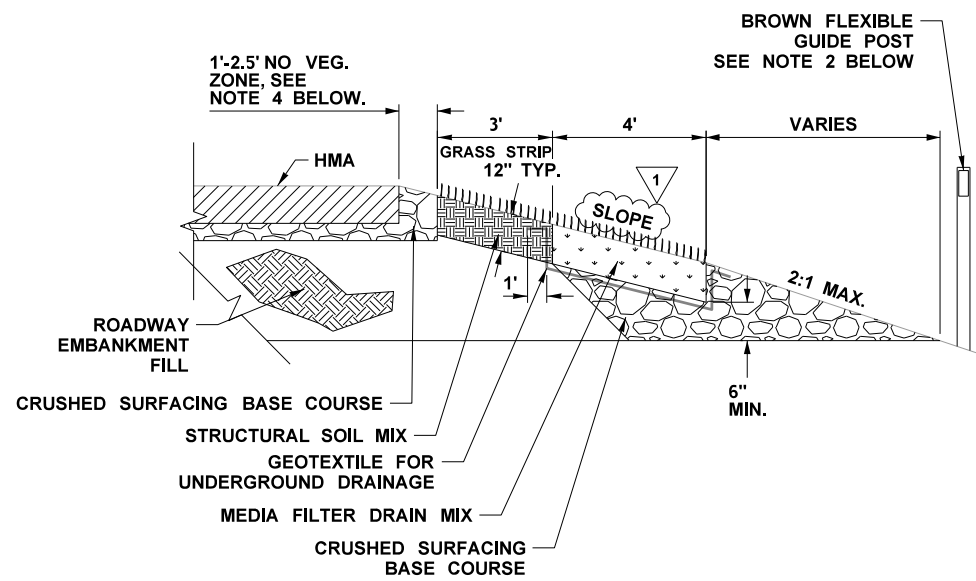




**MEDIA FILTER DRAIN - TYPE 1**



**MEDIA FILTER DRAIN - TYPE 1A**



**MEDIA FILTER DRAIN - TYPE 3**

**MEDIA FILTER DRAIN DETAILS**  
N.T.S.

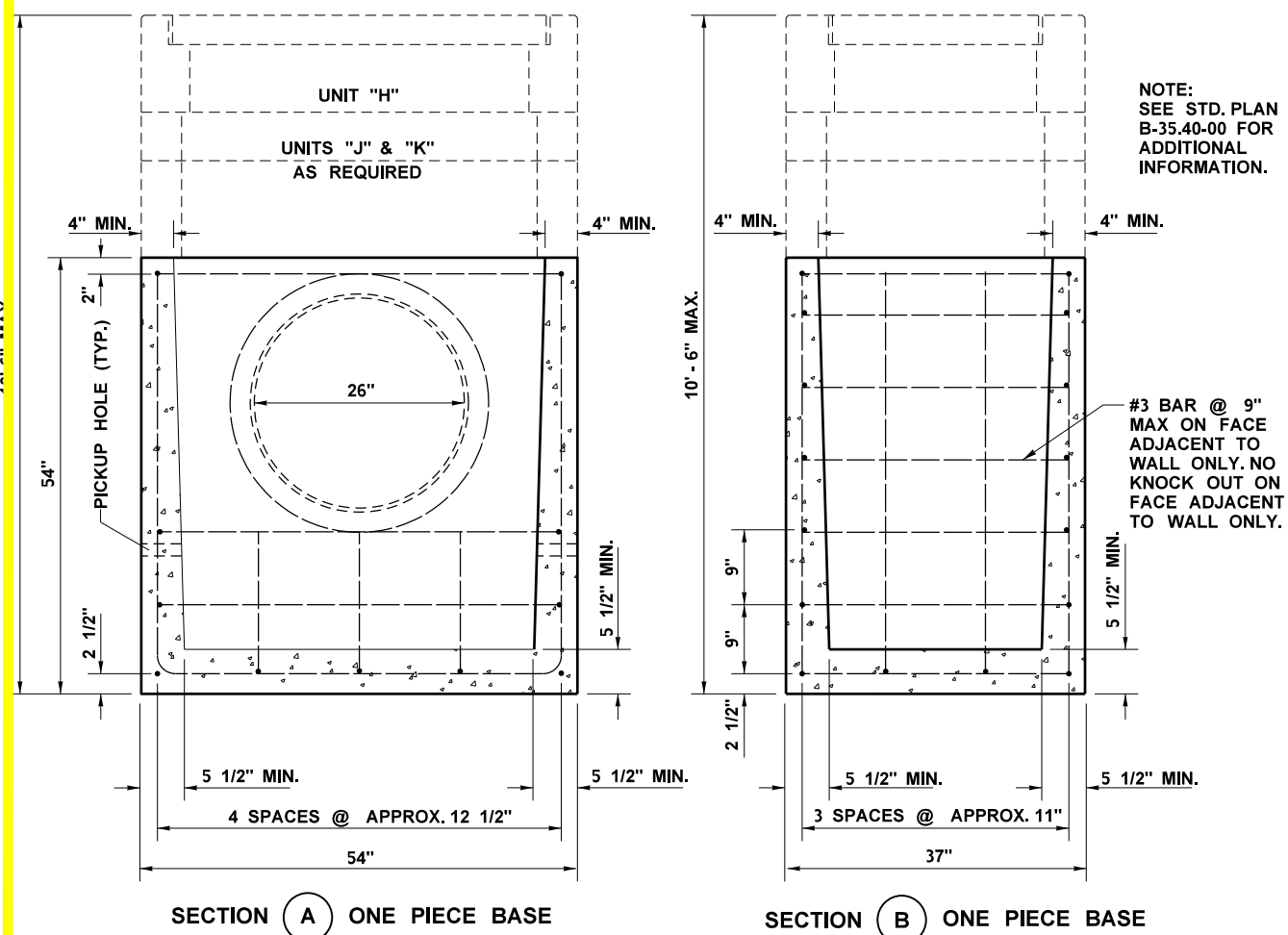
**MEDIA FILTER DRAIN TABLE**

STRUCTURE NOTE	START STATION	START OFFSET	END STATION	END OFFSET	LENGTH (LF)	SLOPE (H:V)	TYPE
DR07-4	NB167 323+25.26	36.42' RT	NB167 334+45.54	38.27' RT	1,120	4:1	3
DR07-7	NB167 318+04.40	35.00' RT	NB167 319+73.37	35.00' RT	169	4:1	3
DR13-31	SB405 1219+75.21	50.00' LT	SB405 1225+45.60	56.50' LT	570	4:1	1
DR13-31	SB405 1225+45.60	56.50' LT	SB405 1226+13.50	56.50' LT	68	6:1	1
DR14-11	SB405 1226+90.00	56.50' LT	SB405 1227+23.50	64.50' LT	34	6:1	1
DR14-11	SB405 1227+23.50	64.50' LT	SB405 1230+13.86	45.00' LT	290	6:1	1A

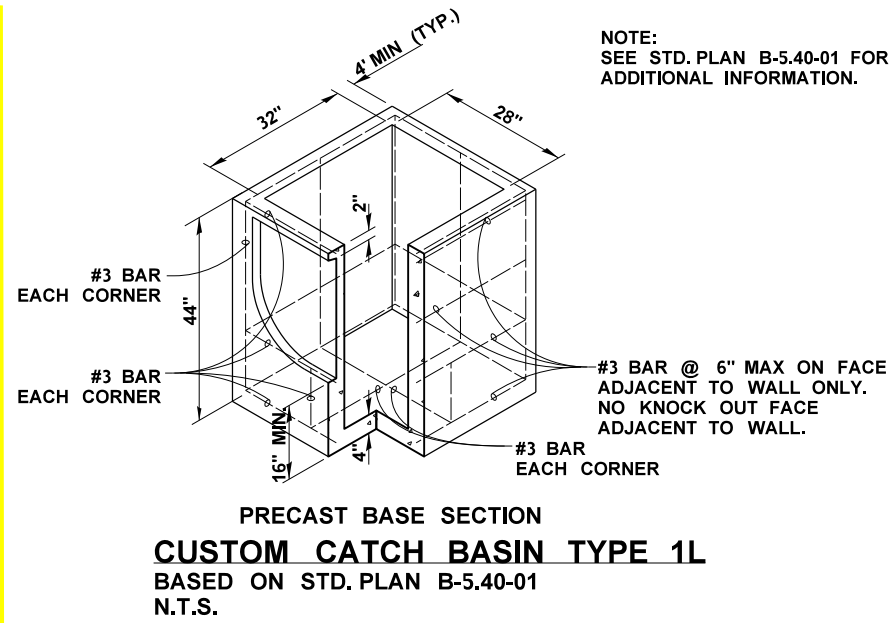
ATKINSON  
NOV 28 2017  
RELEASED FOR CONSTRUCTION

**MFD NOTES:**

- REFER TO ROADWAY SECTIONS FOR SIDE SLOPE GEOMETRY. WIDTH OF NO VEGETATION ZONE VARIES TO ACCOMMODATE GUARDRAIL INSTALLATIONS.
- INSTALL FLEXIBLE GUIDE POSTS (WITH NON-RELECTIVE SHEETING) AT THE BEGINNING AND END OF THE MEDIA FILTER DRAIN RUN AND ALONG THE LENGTH OF THE MEDIA FILTER DRAIN AT 500 FOOT SPACING (MAX). WHERE COINCIDENT WITH GUARDRAIL, GUIDE POST SHALL BE MOUNTED TO GUARDRAIL PER STD. PLAN M-40.10-03.
- PROVIDE A CLEANOUT AT THE UPSTREAM END OF THE UNDERDRAIN. THIS CLEANOUT MAY BE A 90° ELBOW EQUAL IN DIAMETER TO THE UNDERDRAIN WITH REMOVABLE CAP AT GRADE OR CATCH BASIN TYPE 1. PROVIDE CLEANOUTS AT 300' MAX. SPACING ALONG THE UNDERDRAIN AND AT JUNCTIONS. THESE CLEANOUTS MAY BE A TEE FITTING EQUAL IN DIAMETER TO THE UNDERDRAIN WITH REMOVABLE CAP AT GRADE OR CATCH BASIN TYPE 1.
- NO VEGETATION ZONE FOR MFD SHALL BE 1' EXCEPT AT GUARDRAILS IT SHALL BE 2.5'.
- SEE MEDIA FILTER DRAIN SPECIFICATION ON SHEET DD06.

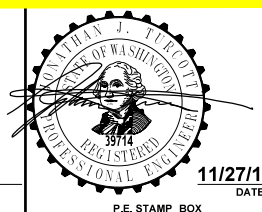


**CUSTOM GRATE INLET TYPE 2 ROTATED**  
BASED ON STD. PLAN B-35.40-00  
N.T.S.



**PRECAST BASE SECTION**  
**CUSTOM CATCH BASIN TYPE 1L**  
BASED ON STD. PLAN B-5.40-01  
N.T.S.

FILE NAME	c:\pwworking\inat_x_jzigweid\0521992\08811_DE_DD05.dgn	REGION NO.	10	STATE	WASH	FED.AID PROJ.NO.	
TIME	3:45:35 PM						
DATE	11/27/2017						
PLOTTED BY	JZigweid	REV. 1 - RFC	RFI0181	11/27/17			
DESIGNED BY	J. TURCOTT	REV. C - FINAL REVIEW		11/3/17			
ENTERED BY	E. JACKSON	REV. 0 - RFC		6/16/17			
CHECKED BY	J. ZIGWEID	REV. B - FINAL REVIEW		4/14/17			
PROJ. ENGR.	C. CHEN	REV. A - PRELIMINARY REVIEW		1/27/17			
REGIONAL ADM.	L. ENG	REVISION		DATE	BY	C8811	



I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR	PLAN REF NO DD05
DRAINAGE DETAILS	SHEET OF SHEETS



### DESCRIPTION

THIS WORK SHALL CONSIST OF CONSTRUCTING MEDIA FILTER DRAINS AND PLACING COMPOST.

## MATERIALS

MEDIUM COMPOST	9-14.4(8)
GEOTEXTILE FOR UNDERGROUND DRAINAGE	9-33

## MEDIA FILTER DRAIN

### MEDIA FILTER DRAIN MIX

MEDIA FILTER DRAIN MIX SHALL BE MIXED IN THE FOLLOWING PROPORTIONS: 3 CUBIC YARDS OF AGGREGATE, 1 CUBIC YARD OF HORTICULTURAL GRADE PERLITE, 40 POUNDS OF AGRICULTURAL GRADE DOLOMITE, AND 12 POUNDS OF AGRICULTURAL GRADE GYPSUM. MEDIA FILTER DRAIN MIX SHALL BE PREMIXED PRIOR TO PLACEMENT. THE SOIL AMENDMENTS AND AGGREGATE SHALL MEET THE FOLLOWING REQUIREMENTS PRIOR TO MIXING:

### AGGREGATE FOR MEDIA FILTER DRAIN MIX

AGGREGATE FOR MEDIA FILTER DRAIN MIX SHALL MEET ALL REQUIREMENTS FOR SECTION 9-03.4 AGGREGATE FOR BITUMINOUS SURFACE TREATMENT - CRUSHED SCREENINGS 3/8-INCH TO NO. 4 EXCEPT THE FRACTURE REQUIREMENT SHALL BE AT LEAST TWO FRACTURED FACES AND WILL APPLY TO MATERIAL RETAINED ON THE U.S. NO. 4 SIEVE IN ACCORDANCE WITH FOP FOR AASHTO T 335.

**HORTICULTURAL GRADE PERLITE**

HORTICULTURAL GRADE PERLITE SHALL BE PER SECTION 9-14.4(9), MEET THE FOLLOWING GRADING REQUIREMENTS, AND NOT CONTAIN ANY TOXIC MATERIAL:

SIEVE SIZE	% PASSING
NO. 4	99% - 100%
NO. 18	0% - 30%
NO. 30	0% - 10%

**AGRICULTURAL GRADE DOLOMITE**

AGRICULTURAL GRADE DOLOMITE SHALL BE PER SECTION 9-14.4(5) AND MEET THE REQUIREMENTS OF ASTM C 602 CLASS DESIGNATION E.

**AGRICULTURAL GRADE GYPSUM**

AGRICULTURAL GRADE GYPSUM SHALL BE PER SECTION 9-14.4(6) AND MEET THE FOLLOWING GRADING REQUIREMENTS:

SIEVE SIZE	% PASSING
1/4-INCH	99% - 100%
NO. 20	0% - 20%

THE ACCEPTANCE OF THE AGGREGATE SHALL BE BASED ON A SATISFACTORY TEST REPORT FOR EVERY 1000 TONS. TESTING OF AGGREGATE SHALL OCCUR PRIOR TO MIXING WITH THE SOIL AMENDMENTS. HORTICULTURAL GRADE PERLITE, AGRICULTURAL GRADE DOLOMITE AND GYPSUM WILL BE ACCEPTED BY CATALOG CUT OR BAG LABEL.

THE FINISHED PRODUCT SHALL BE CLEAN, UNIFORMLY MIXED, AND FREE FROM WOOD, BARK, ROOTS, AND OTHER DELETERIOUS MATERIALS.

## STRUCTURAL SOIL MIX

THE STRUCTURAL SOIL MIX FOR THE GRASS STRIP SHALL CONSIST OF A UNIFORM BLEND COMPOSED BY VOLUME OF 70% TO 80% AGGREGATE, 20% TO 30% COMPOST. 100% OF THE MIXTURE SHALL PASS THROUGH A 2-1/2 INCH SIEVE.

## COMPOST

COMPOST SHALL BE MEDIUM COMPOST AND MEET THE MATERIAL REQUIREMENTS AS SPECIFIED IN SECTION 9-14.4(8).

## AGGREGATE

AGGREGATE SHALL CONSIST OF BALLAST IN ACCORDANCE WITH SECTION 9-03.9(1).

## MIXING REQUIREMENTS

THE CONTRACTOR SHALL SUBMIT THE PROPOSED METHOD OF MIXING IN WRITING FOR THE ENGINEER'S APPROVAL. NO MIXING SHALL TAKE PLACE WITHOUT WRITTEN APPROVAL FROM THE ENGINEER.

STRUCTURAL SOIL MIX SHALL BE THOROUGHLY MIXED PRIOR TO BEING PLACED.

## CONSTRUCTION REQUIREMENTS

SECTION 7-01.3 IS SUPPLEMENTED WITH THE FOLLOWING:

## MEDIA FILTER DRAIN

THE CONTRACTOR SHALL CONSTRUCT THE MEDIA FILTER DRAIN IN ACCORDANCE WITH THE DETAILS IN THE PLANS.

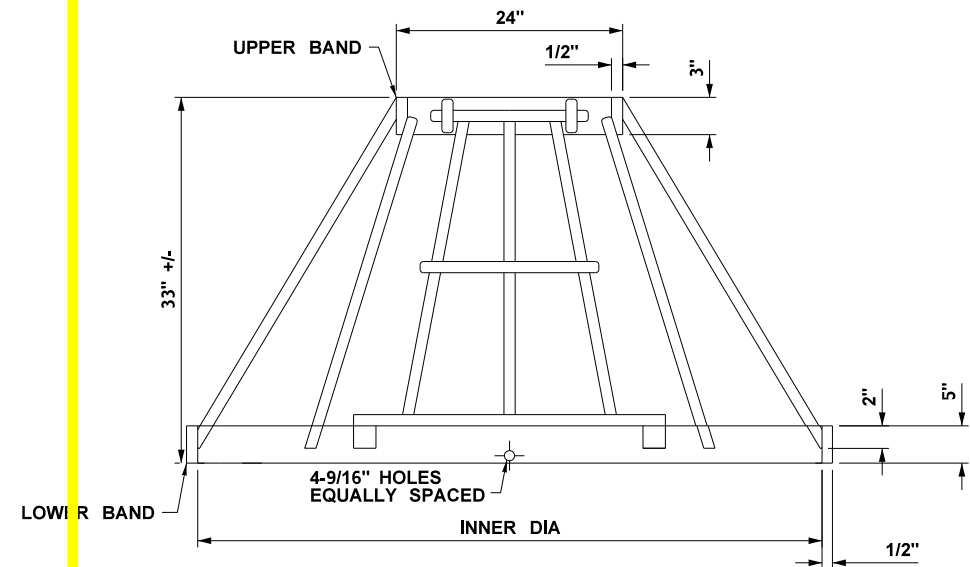
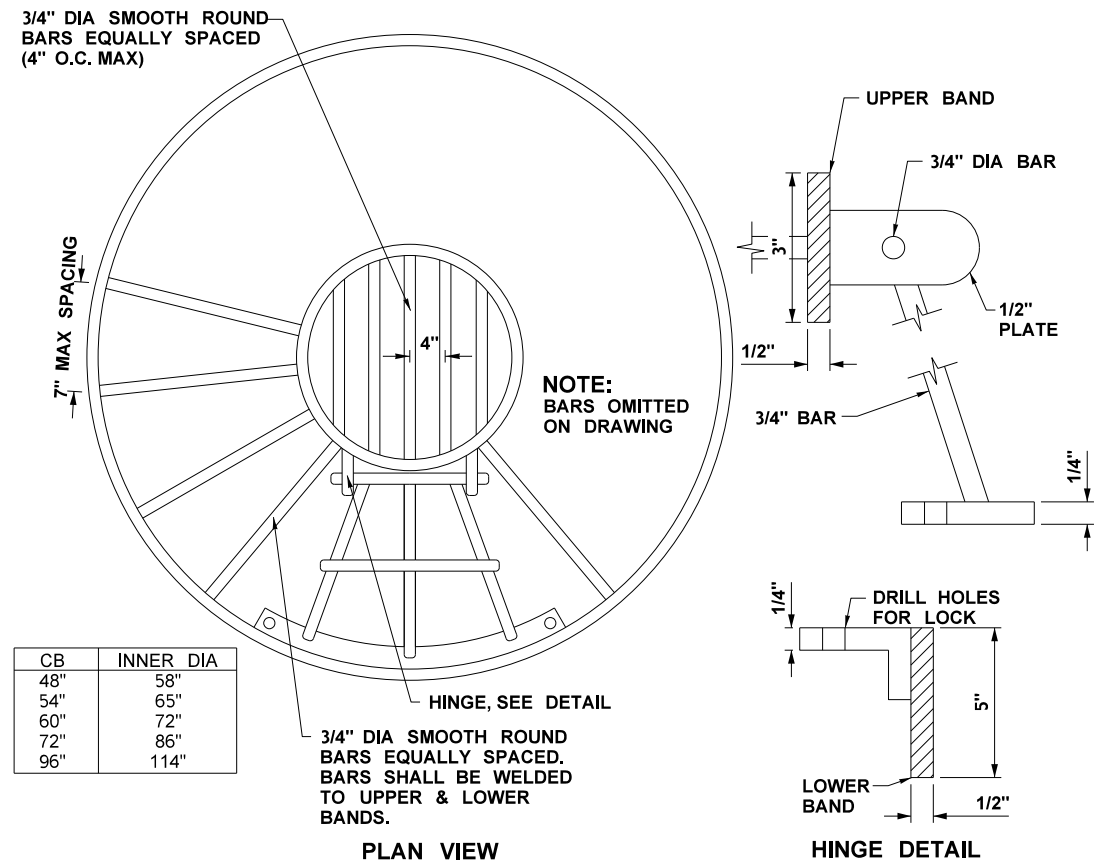
THE CONTRACTOR SHALL CONDUCT THE INSTALLATION OF THE MEDIA FILTER DRAIN SUCH THAT THE DIFFERENT SECTIONS OF THE MEDIA FILTER DRAIN ARE NOT CONTAMINATED OR DISPLACED BY OTHER MATERIALS DURING INSTALLATION.

THE CONTRACTOR SHALL NOT SEED, FERTILIZE OR MULCH THE MEDIA FILTER DRAIN MIX.

ONCE INSTALLED, THE CONTRACTOR WILL NOT BE ALLOWED TO DRIVE EQUIPMENT OVER THE AREA OF THE MEDIA FILTER DRAIN.

MEDIA FILTER DRAIN EXCAVATION SHALL CONFORM TO SECTION 2-09.3(4). EXCAVATED MATERIAL SUITABLE FOR USE IN EMBANKMENT MAY BE USED AT THE DISCRETION OF THE ENGINEER. OTHERWISE, THE MATERIAL EXCAVATED SHALL BECOME PROPERTY OF THE CONTRACTOR.

THE CONTRACTOR SHALL PLACE THE STRUCTURAL SOIL MIX IN LAYERS NO MORE THAN 5-INCHES IN DEPTH BEFORE COMPACTION. EACH LAYER SHALL BE COMPACTED BY THREE PASSES OF A VIBRATORY PLATE COMPACTOR. AFTER PLACEMENT AND COMPACTION OF STRUCTURAL SOIL MIX, MEDIUM COMPOST SHALL BE PLACED TO A DEPTH OF TWO INCHES PRIOR TO SEEDING, FERTILIZING AND MULCHING.



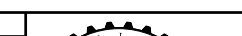

**ELEVATION VIEW**

**NOTE:**

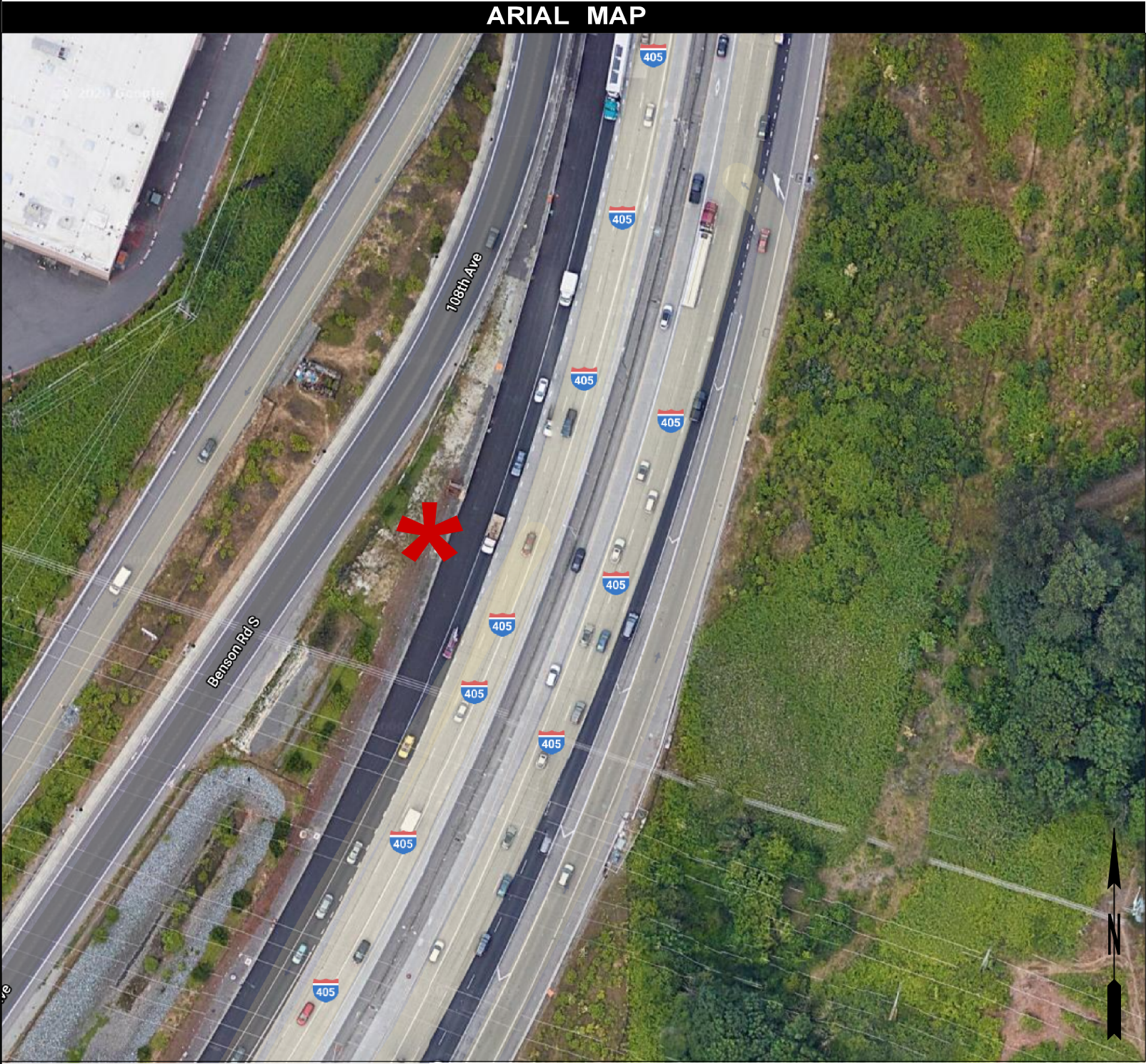
ALL PARTS MUST BE EITHER ALUMINUM OR STAINLESS STEEL. NO GALVANIZED MATERIAL TO BE USED.

## DEBRIS CAGE

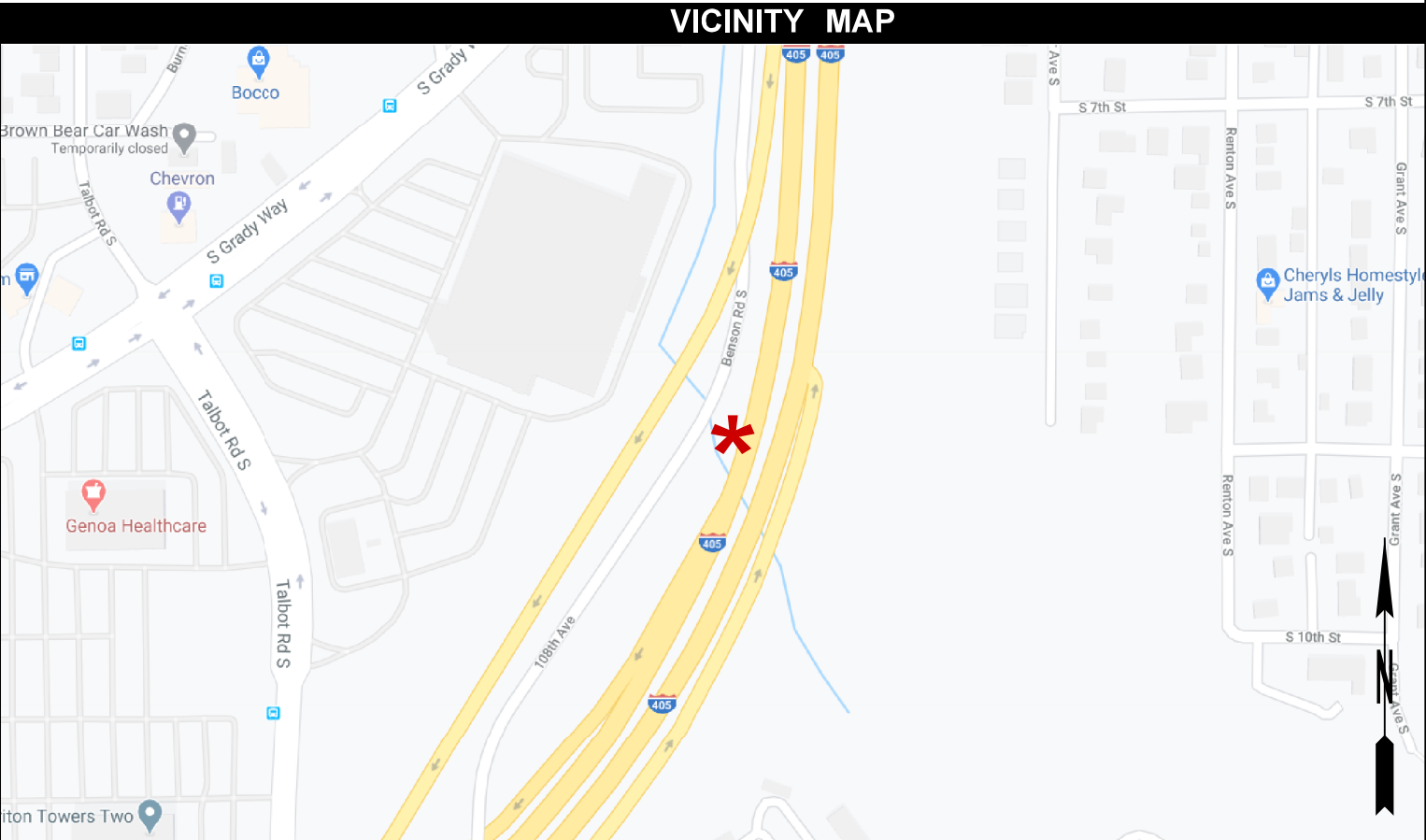
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DATE 6/8/2017						10 WASH										
PLOTTED BY EJackson								JOB NUMBER				SHEET				
DESIGNED BY J. TURCOTT												OF				
ENTERED BY E. JACKSON		REV. 0 - RFC		6/16/17								SHEETS				
CHECKED BY J. ZIGWEID		REV. B - FINAL REVIEW		4/14/17		CONTRACT NO.		LOCATION NO.								
PROJ. ENGR. C. CHEN		REV. A - PRELIMINARY REVIEW		01/27/17		C8811										
REGIONAL ADM. L. ENG		REVISION		DATE		BY										

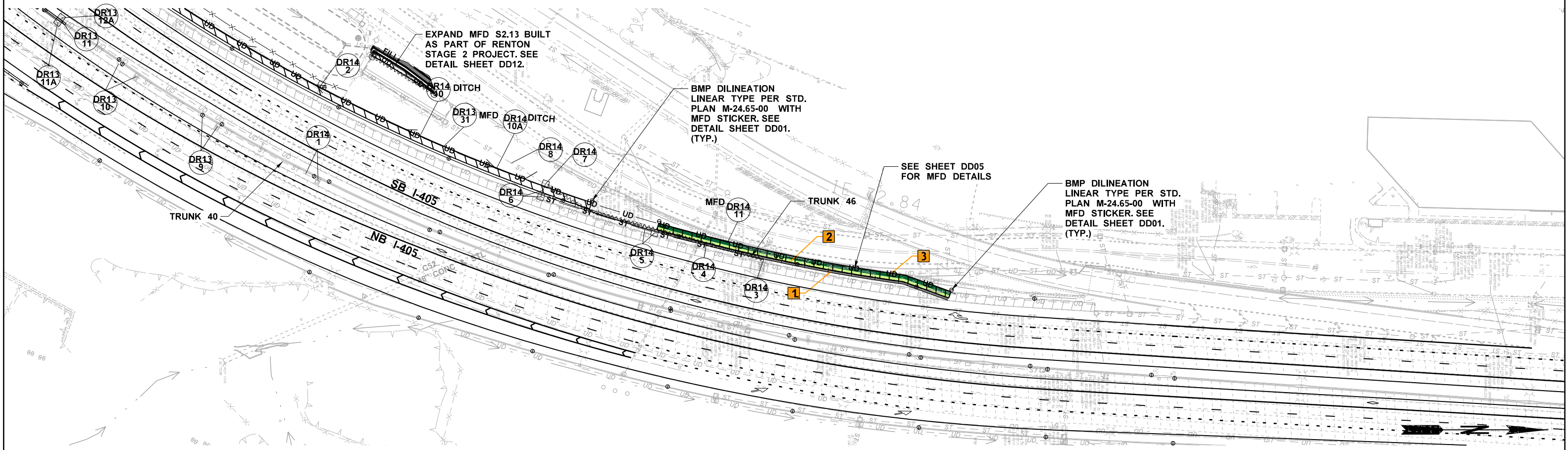




SITE INFORMATION	
LOCATION:	I-405 MP 3.1
FACILITY TYPE:	MEDIA FILTER DRAIN
MAINTENANCE RESPONSIBILITY:	WSDOT
DESIGN:	OL-XXXX   CONSTRUCTION: 01XXXX   JOB NUMBER: XXXX
HYDRAULIC REPORT	TBD
MODIFIED BY:	N/A
SITE DESCRIPTION:	THIS IS A 324 LF MEDIA FILTER DRAIN PROVIDING ENHANCED WATER QUALITY.
AS-BUILT FIELD VERIFICATION:	N/A
SURVEY BENCH MARK:	TBD
FEATURE ANOMALIES:	N/A
DISCLAIMER:	NOTIFY MAINTENANCE SUPERVISOR IF THE BMP IS NOT CHARACTERISTIC OF THIS OWNER'S MANUAL TO FACILITATE MAINTENANCE ACTIVITIES. CONTACT MAINTENANCE SUPERINTENDENT BEFORE ANY MAINTENANCE TAKES PLACE.
DIRECTIONS:	







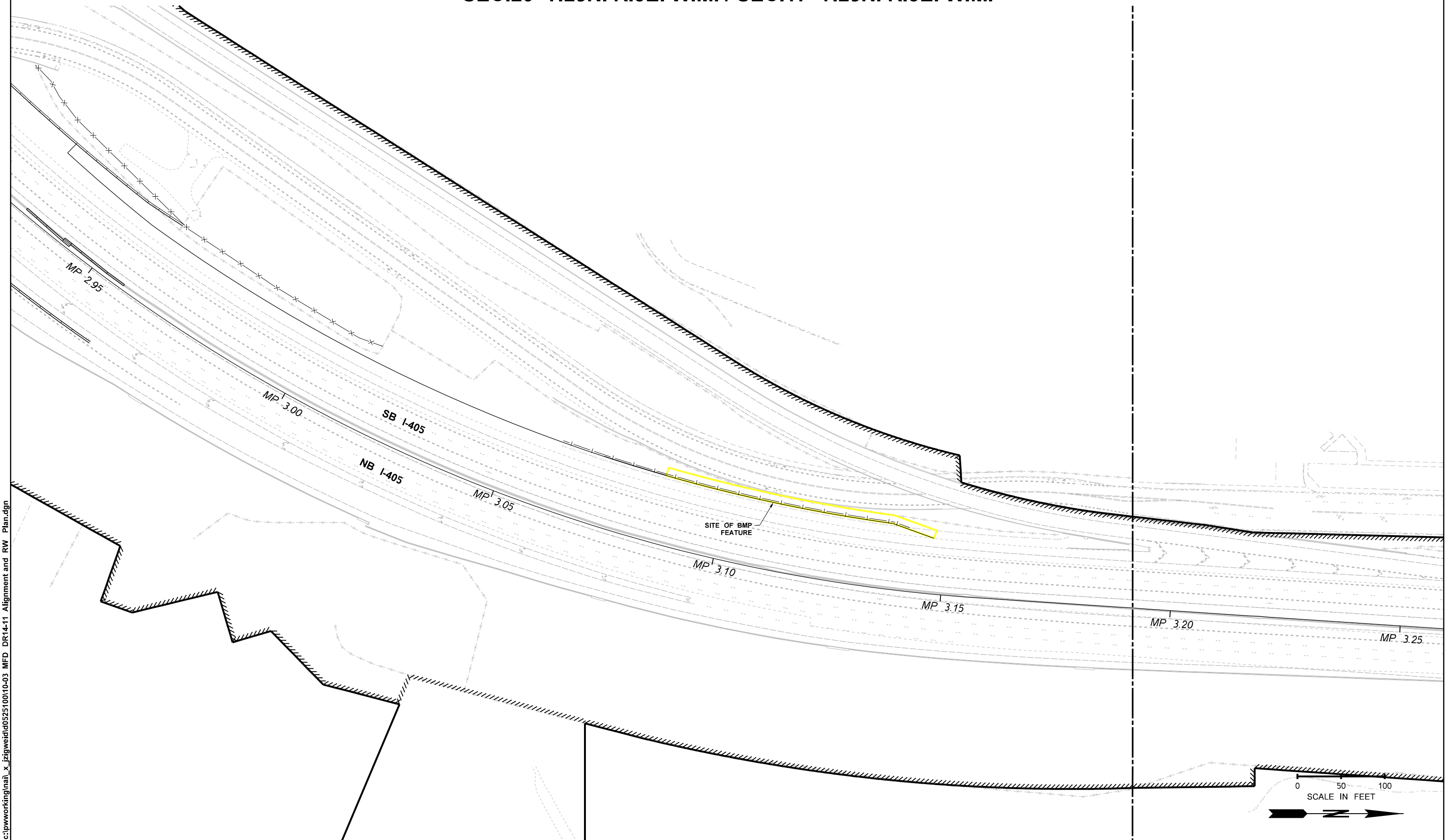
NO.	ITEM	PURPOSE
1	NON-VEGETATION ZONE	ENSURES DISPERSION AND PROVIDES SOME POLUTANT TRAPPING.
2	GRASS STRIP	PROVIDES PRETREATMENT AND SEDIMENT REMOVAL.
3	MEDIA FILTER DRAIN MIX	PROVIDE ENHANCED WATER QUALITY TREATMENT.

NO.	ITEM	BMP MAINTENANCE ACTIVITY
NOTE: THE FOLLOWING ITEMS SUPPLEMENT HRM TABLES 5-12 THROUGH 5-24. REFER TO TABLES 5-12 THROUGH 5-24 FOR GENERAL MAINTENANCE ACTIVITIES.		
1	NON-VEGETATION ZONE	REMOVE ALL VEGETATION FROM NON-VEGETATION ZONE.
2	GRASS STRIP	REFER TO HRM TABLES 5-12 THROUGH 5-24.
3	MEDIA FILTER DRAIN MIX	REFER TO HRM TABLES 5-12 THROUGH 5-24.

LEGEND	
	- DRAINAGE STRUCTURE ID CONTINUED
	- STORM SEWER PIPE
	- CATCH BASIN
	- ROCK OUTFALL PROTECTION
	- MEDIA FILTER DRAIN
	- EXISTING STORM TO BE REMOVED OR ABANDONED

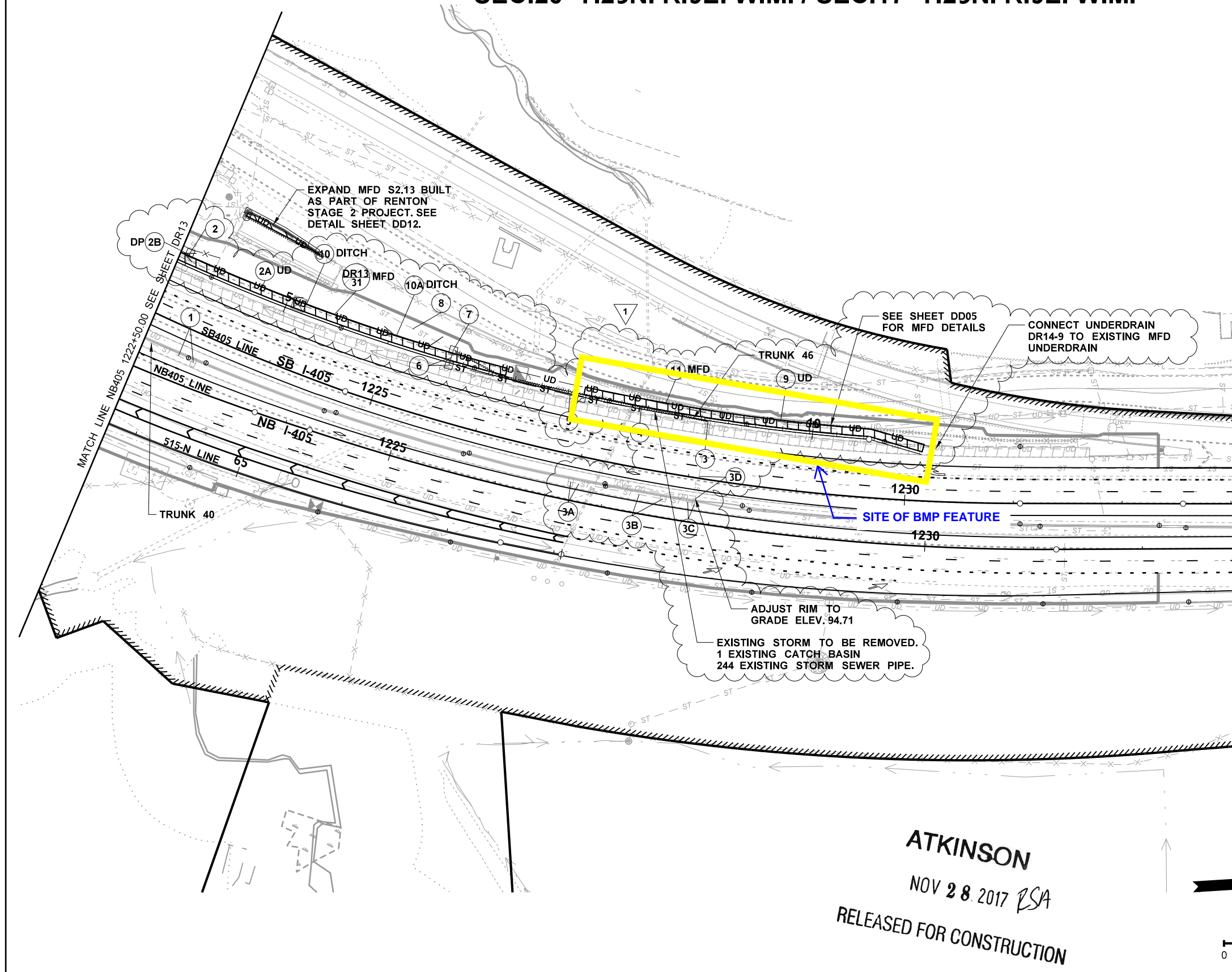
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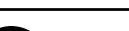




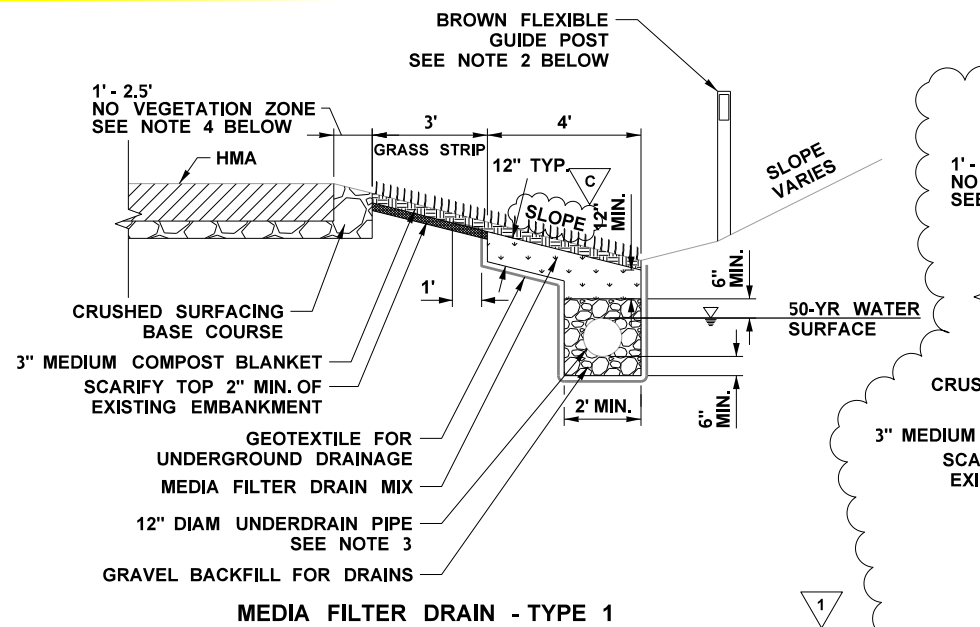


DRAINAGE REFERENCE SUMMARY	
DESCRIPTION	PROFILE/DETAIL SHEET(S)
TRUNK 40	DP21
TRUNK 46	DP24
DRAIN PIPE DR14-2B	DP56

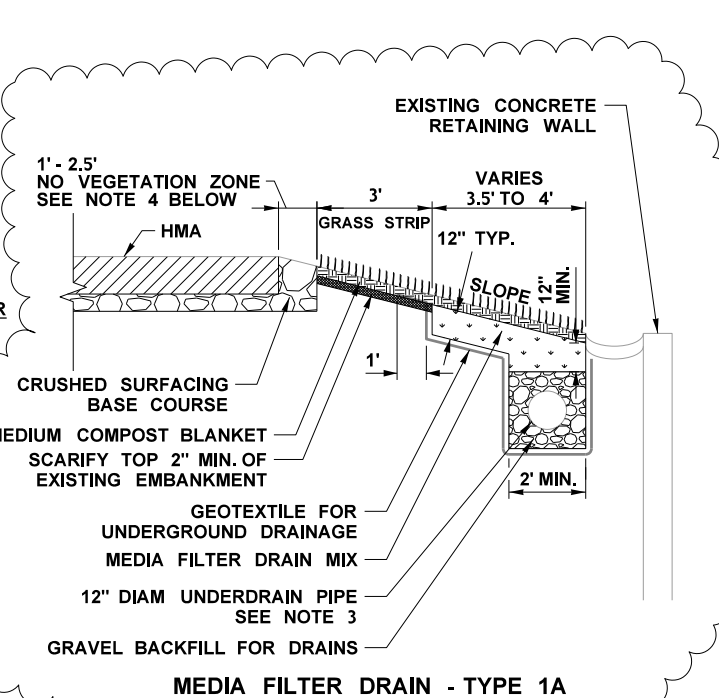


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TIME 3:35:30 PM						FED.AID PROJ.NO.		DR14								
DATE 11/27/2017								10 WASH						SHEET		
PLOTTED BY JZigweid		REV. 1 - RFC RFI0181		11/27/17				JOB NUMBER						OF		
DESIGNED BY J. TURCOTT		REV. C - FINAL REVIEW		11/3/17												
ENTERED BY E. JACKSON		REV. 0 - RFC		6/16/17												
CHECKED BY J. ZIGWEID		REV. B - FINAL REVIEW		4/14/17				CONTRACT NO.		LOCATION NO.						
PROJ. ENGR. C. CHEN		REV. A - PRELIMINARY REVIEW		1/27/17				C8811						SHEETS		
REGIONAL ADM. L. ENG		REVISION		DATE		BY										

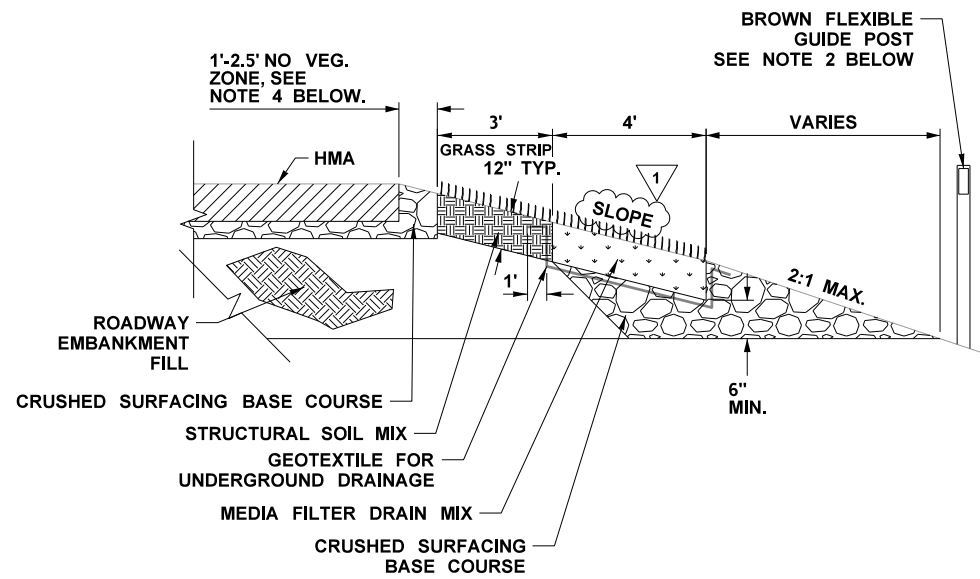




MEDIA FILTER DRAIN - TYPE 1



MEDIA FILTER DRAIN - TYPE 1A



MEDIA FILTER DRAIN - TYPE 3

**MEDIA FILTER DRAIN DETAILS**  
N.T.S.

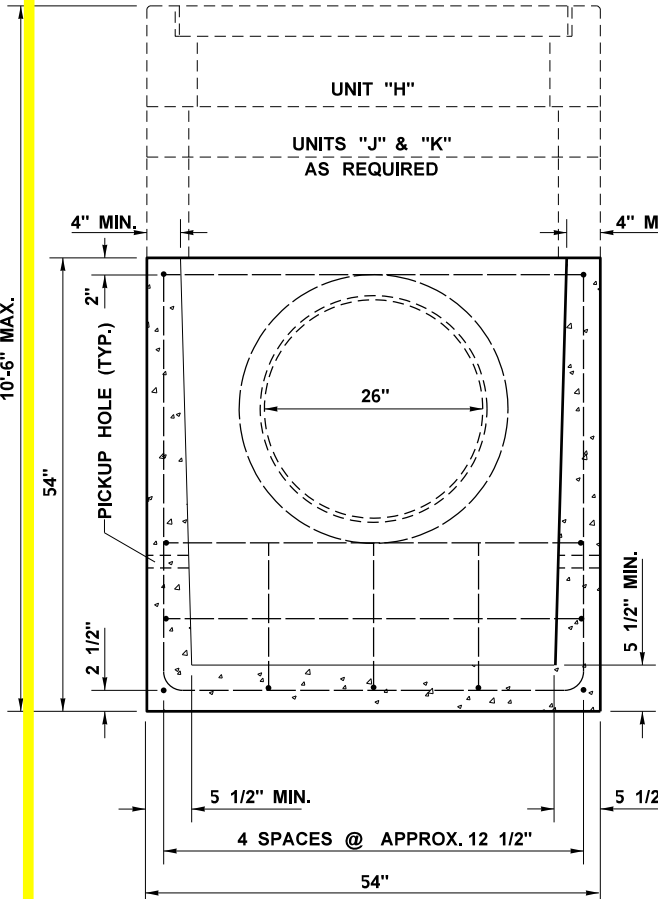
MEDIA FILTER DRAIN TABLE

STRUCTURE NOTE	START STATION	START OFFSET	END STATION	END OFFSET	LENGTH (LF)	SLOPE (H:V)	TYPE
DR07-4	NB167 323+25.26	36.42' RT	NB167 334+45.54	38.27' RT	1,120	4:1	3
DR07-7	NB167 318+04.40	35.00' RT	NB167 319+73.37	35.00' RT	169	4:1	3
DR13-31	SB405 1219+75.21	50.00' LT	SB405 1225+45.60	56.50' LT	570	4:1	1
DR13-31	SB405 1225+45.60	56.50' LT	SB405 1226+13.50	56.50' LT	68	6:1	1
DR14-11	SB405 1226+90.00	56.50' LT	SB405 1227+23.50	64.50' LT	34	6:1	1
DR14-11	SB405 1227+23.50	64.50' LT	SB405 1230+13.86	45.00' LT	290	6:1	1A

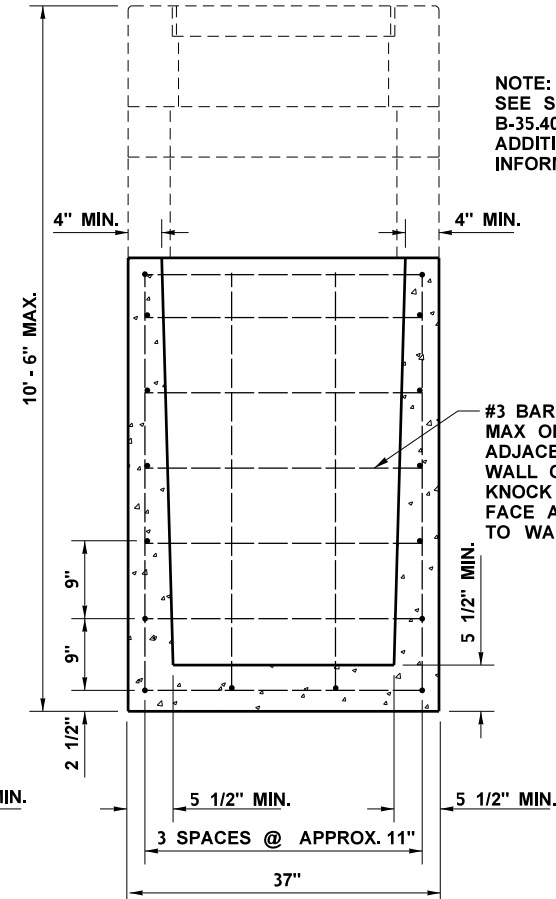
ATKINSON  
NOV 28 2017  
RELEASED FOR CONSTRUCTION

**MFD NOTES:**

- REFER TO ROADWAY SECTIONS FOR SIDE SLOPE GEOMETRY. WIDTH OF NO VEGETATION ZONE VARIES TO ACCOMMODATE GUARDRAIL INSTALLATIONS.
- INSTALL FLEXIBLE GUIDE POSTS (WITH NON-RELECTIVE SHEETING) AT THE BEGINNING AND END OF THE MEDIA FILTER DRAIN RUN AND ALONG THE LENGTH OF THE MEDIA FILTER DRAIN AT 500 FOOT SPACING (MAX). WHERE COINCIDENT WITH GUARDRAIL, GUIDE POST SHALL BE MOUNTED TO GUARDRAIL PER STD. PLAN M-40.10-03.
- PROVIDE A CLEANOUT AT THE UPSTREAM END OF THE UNDERDRAIN. THIS CLEANOUT MAY BE A 90° ELBOW EQUAL IN DIAMETER TO THE UNDERDRAIN WITH REMOVABLE CAP AT GRADE OR CATCH BASIN TYPE 1. PROVIDE CLEANOUTS AT 300' MAX. SPACING ALONG THE UNDERDRAIN AND AT JUNCTIONS. THESE CLEANOUTS MAY BE A TEE FITTING EQUAL IN DIAMETER TO THE UNDERDRAIN WITH REMOVABLE CAP AT GRADE OR CATCH BASIN TYPE 1.
- NO VEGETATION ZONE FOR MFD SHALL BE 1' EXCEPT AT GUARDRAILS IT SHALL BE 2.5'.
- SEE MEDIA FILTER DRAIN SPECIFICATION ON SHEET DD06.

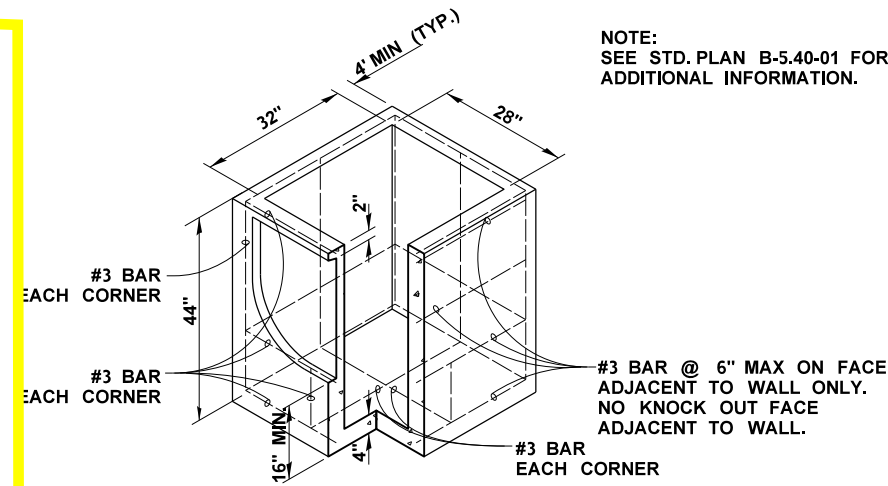


SECTION A ONE PIECE BASE



SECTION B ONE PIECE BASE

**CUSTOM GRATE INLET TYPE 2 ROTATED**  
BASED ON STD. PLAN B-35.40-00  
N.T.S.



**PRECAST BASE SECTION**  
**CUSTOM CATCH BASIN TYPE 1L**  
BASED ON STD. PLAN B-5.40-01  
N.T.S.

FILE NAME: c:\pwworking\atkins\167\167.dwg

TIME	3:45:35 PM			REGION NO.	STATE	FED.AID PROJ.NO.
DATE	11/27/2017			10	WASH	
PLOTTED BY	JZigweid	REV. 1 - RFC RFI0181	11/27/17			
DESIGNED BY	J. TURCOTT	REV. C - FINAL REVIEW	11/3/17			
ENTERED BY	E. JACKSON	REV. 0 - RFC	6/16/17			
CHECKED BY	J. ZIGWEID	REV. B - FINAL REVIEW	4/14/17			
PROJ. ENGR.	C. CHEN	REV. A - PRELIMINARY REVIEW	1/27/17			
REGIONAL ADM.	L. ENG	REVISION	DATE	BY	C8811	

P.E. STAMP BOX



P.E. STAMP BOX



I-405 / SR 167 INTERCHANGE  
DIRECT CONNECTOR

DRAINAGE DETAILS

PLAN REF NO  
DD05  
SHEET  
OF  
SHEETS



### DESCRIPTION

THIS WORK SHALL CONSIST OF CONSTRUCTING MEDIA FILTER DRAINS AND PLACING COMPOST.

REFER TO SHEET DD05 FOR TYPICAL MEDIA FILTER DRAIN CONFIGURATIONS.

## MATERIALS

SECTION 7-01.2 IS SUPPLEMENTED WITH THE FOLLOWING:

MEDIUM COMPOST	9-14.4(8)
GEOTEXTILE FOR UNDERGROUND DRAINAGE	9-33

## MEDIA FILTER DRAIN

### MEDIA FILTER DRAIN MIX

MEDIA FILTER DRAIN MIX SHALL BE MIXED IN THE FOLLOWING PROPORTIONS: 3 CUBIC YARDS OF AGGREGATE, 1 CUBIC YARD OF HORTICULTURAL GRADE PERLITE, 40 POUNDS OF AGRICULTURAL GRADE DOLOMITE, AND 12 POUNDS OF AGRICULTURAL GRADE GYPSUM. MEDIA FILTER DRAIN MIX SHALL BE PREMIXED PRIOR TO PLACEMENT. THE SOIL AMENDMENTS AND AGGREGATE SHALL MEET THE FOLLOWING REQUIREMENTS PRIOR TO MIXING:

### AGGREGATE FOR MEDIA FILTER DRAIN MIX

AGGREGATE FOR MEDIA FILTER DRAIN MIX SHALL MEET ALL REQUIREMENTS FOR SECTION 9-03.4 AGGREGATE FOR BITUMINOUS SURFACE TREATMENT - CRUSHED SCREENINGS 3/8-INCH TO NO. 4 EXCEPT THE FRACTURE REQUIREMENT SHALL BE AT LEAST TWO FRACTURED FACES AND WILL APPLY TO MATERIAL RETAINED ON THE U.S. NO. 4 SIEVE IN ACCORDANCE WITH FOP FOR AASHTO T 335.

**HORTICULTURAL GRADE PERLITE**

HORTICULTURAL GRADE PERLITE SHALL BE PER SECTION 9-14.4(9), MEET THE FOLLOWING GRADING REQUIREMENTS, AND NOT CONTAIN ANY TOXIC MATERIAL:

SIEVE SIZE	% PASSING
NO. 4	99% - 100%
NO. 18	0% - 30%
NO. 30	0% - 10%

**AGRICULTURAL GRADE DOLOMITE**

AGRICULTURAL GRADE DOLOMITE SHALL BE PER SECTION 9-14.4(5) AND MEET THE REQUIREMENTS OF ASTM C 602 CLASS DESIGNATION E.

**AGRICULTURAL GRADE GYPSUM**

AGRICULTURAL GRADE GYP SUM SHALL BE PER SECTION 9-14.4(6) AND MEET THE FOLLOWING GRADING REQUIREMENTS:

SIEVE SIZE	% PASSING
1/4-INCH	99% - 100%
NO. 20	0% - 20%

THE ACCEPTANCE OF THE AGGREGATE SHALL BE BASED ON A SATISFACTORY TEST REPORT FOR EVERY 1000 TONS. TESTING OF AGGREGATE SHALL OCCUR PRIOR TO MIXING WITH THE SOIL AMENDMENTS. HORTICULTURAL GRADE PERLITE, AGRICULTURAL GRADE DOLOMITE AND GYPSUM WILL BE ACCEPTED BY CATALOG CUT OR BAG LABEL.

THE FINISHED PRODUCT SHALL BE CLEAN, UNIFORMLY MIXED, AND FREE FROM WOOD, BARK, ROOTS, AND OTHER DELETERIOUS MATERIALS.

## STRUCTURAL SOIL MIX

THE STRUCTURAL SOIL MIX FOR THE GRASS STRIP SHALL CONSIST OF A UNIFORM BLEND COMPOSED BY VOLUME OF 70% TO 80% AGGREGATE, 20% TO 30% COMPOST. 100% OF THE MIXTURE SHALL PASS THROUGH A 2-1/2 INCH SIEVE.

## COMPOST

COMPOST SHALL BE MEDIUM COMPOST AND MEET THE MATERIAL REQUIREMENTS AS SPECIFIED IN SECTION 9-14.4(8).

## AGGREGATE

AGGREGATE SHALL CONSIST OF BALLAST IN ACCORDANCE WITH SECTION 9-03.9(1).

## MIXING REQUIREMENTS

THE CONTRACTOR SHALL SUBMIT THE PROPOSED METHOD OF MIXING IN WRITING FOR THE ENGINEER'S APPROVAL. NO MIXING SHALL TAKE PLACE WITHOUT WRITTEN APPROVAL FROM THE ENGINEER.

STRUCTURAL SOIL MIX SHALL BE THOROUGHLY MIXED PRIOR TO BEING PLACED.

## CONSTRUCTION REQUIREMENTS

SECTION 7-01.3 IS SUPPLEMENTED WITH THE FOLLOWING:

## MEDIA FILTER DRAIN

THE CONTRACTOR SHALL CONSTRUCT THE MEDIA FILTER DRAIN IN ACCORDANCE WITH THE DETAILS IN THE PLANS.

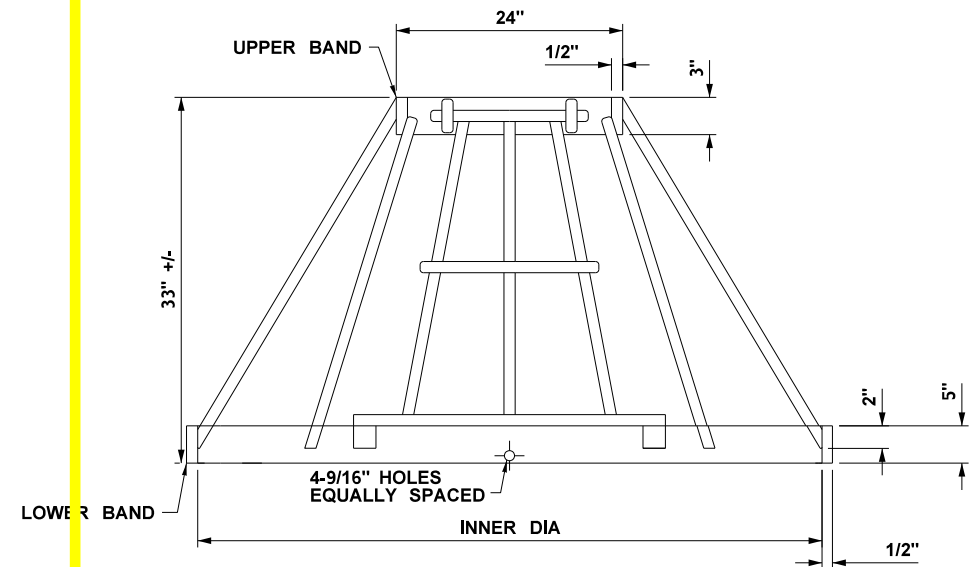
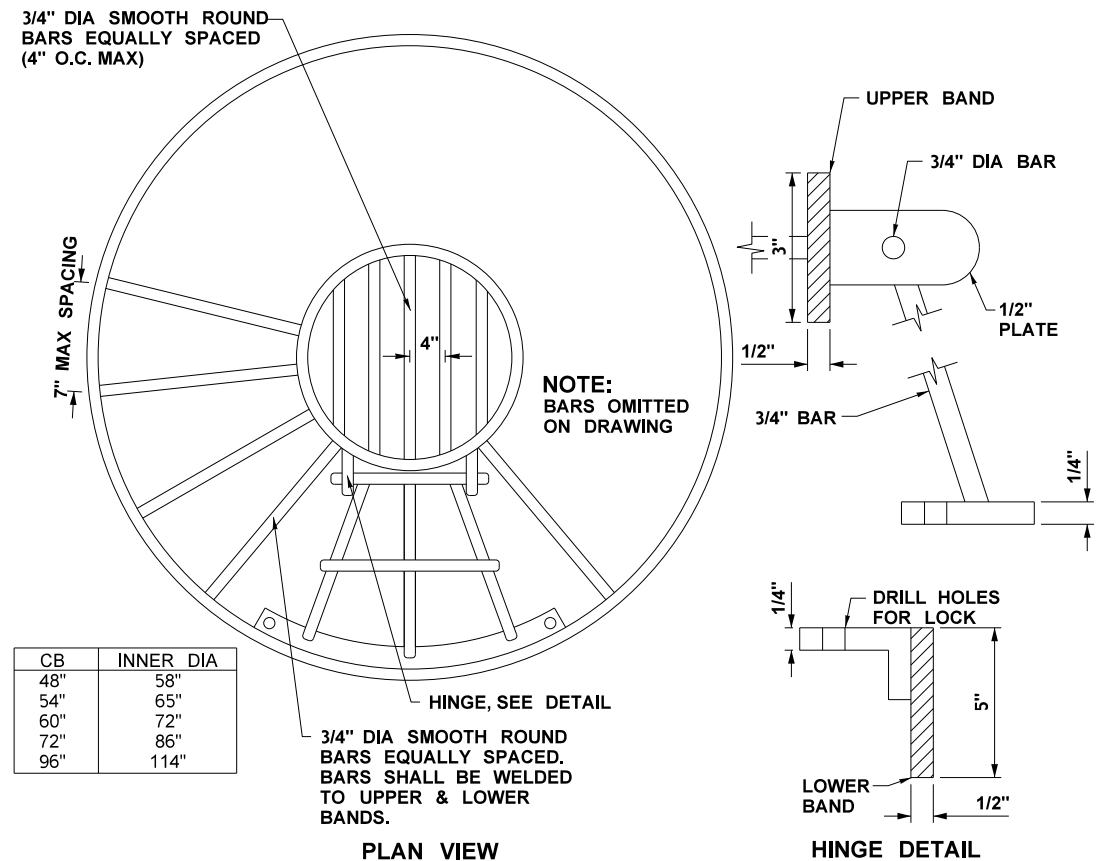
THE CONTRACTOR SHALL CONDUCT THE INSTALLATION OF THE MEDIA FILTER DRAIN SUCH THAT THE DIFFERENT SECTIONS OF THE MEDIA FILTER DRAIN ARE NOT CONTAMINATED OR DISPLACED BY OTHER MATERIALS DURING INSTALLATION.

THE CONTRACTOR SHALL NOT SEED, FERTILIZE OR MULCH THE MEDIA FILTER DRAIN MIX.

ONCE INSTALLED, THE CONTRACTOR WILL NOT BE ALLOWED TO DRIVE EQUIPMENT OVER THE AREA OF THE MEDIA FILTER DRAIN.

MEDIA FILTER DRAIN EXCAVATION SHALL CONFORM TO SECTION 2-09.3(4). EXCAVATED MATERIAL SUITABLE FOR USE IN EMBANKMENT MAY BE USED AT THE DISCRETION OF THE ENGINEER. OTHERWISE, THE MATERIAL EXCAVATED SHALL BECOME PROPERTY OF THE CONTRACTOR.

THE CONTRACTOR SHALL PLACE THE STRUCTURAL SOIL MIX IN LAYERS NO MORE THAN 5-INCHES IN DEPTH BEFORE COMPACTION. EACH LAYER SHALL BE COMPACTED BY THREE PASSES OF A VIBRATORY PLATE COMPACTOR. AFTER PLACEMENT AND COMPACTION OF STRUCTURAL SOIL MIX, MEDIUM COMPOST SHALL BE PLACED TO A DEPTH OF TWO INCHES PRIOR TO SEEDING, FERTILIZING AND MULCHING.





**ELEVATION VIEW**

**NOTE:**

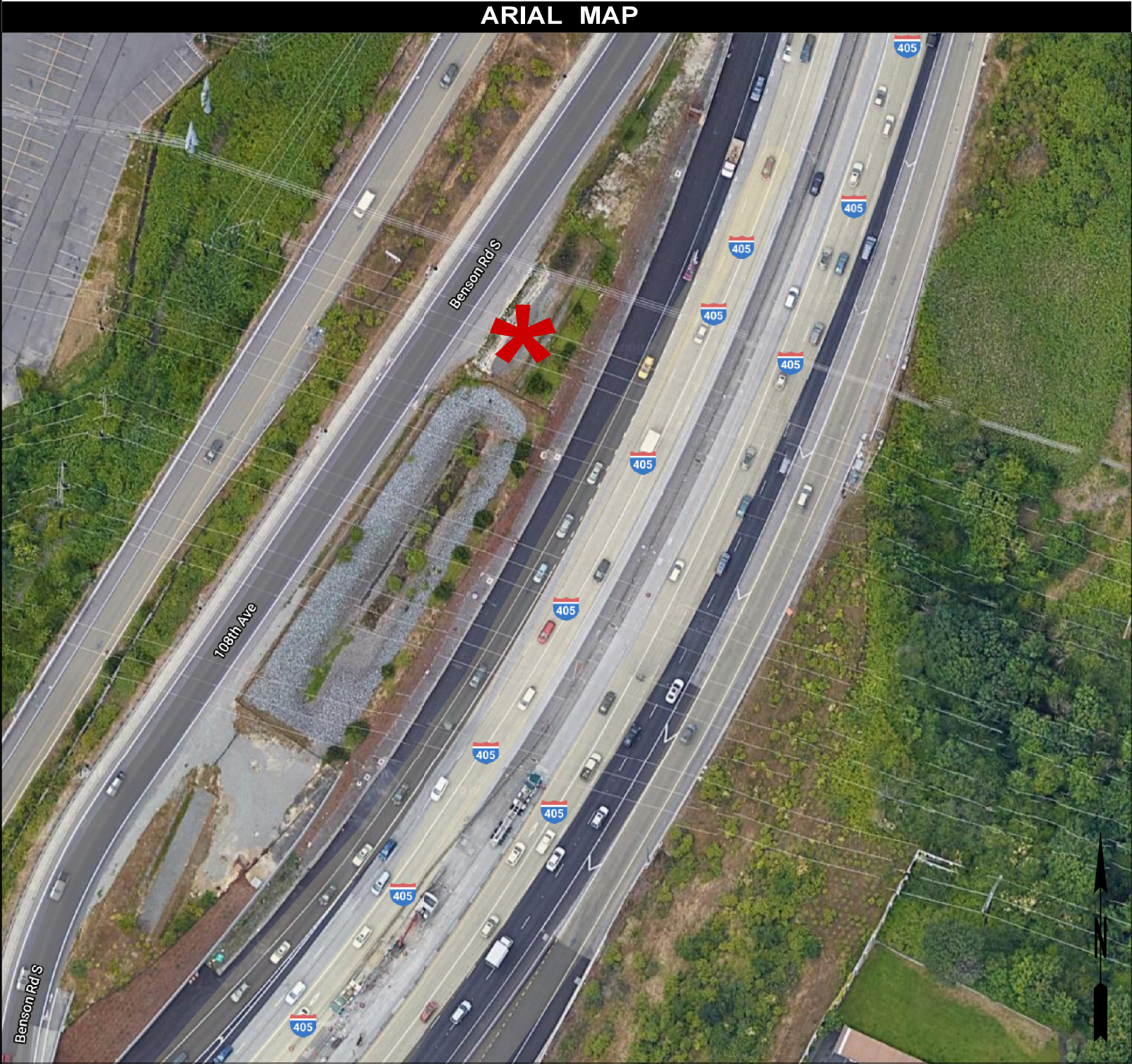
ALL PARTS MUST BE EITHER ALUMINUM OR STAINLESS STEEL. NO GALVANIZED MATERIAL TO BE USED.

## DEBRIS CAGE

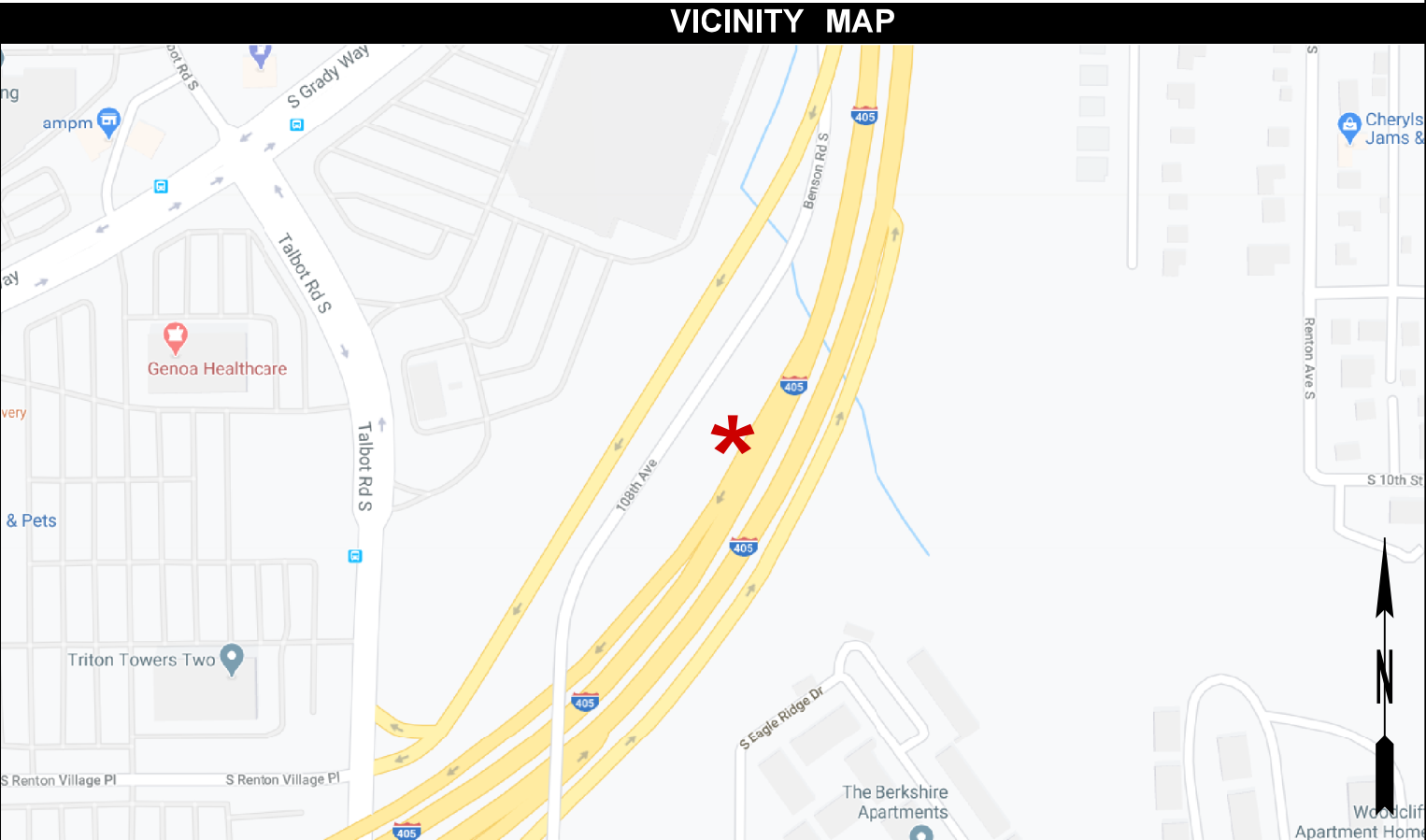
**N.T.S.**

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DATE 6/8/2017				JOB NUMBER				LOCATION NO.						SHEET		
PLOTTED BY EJackson				CONTRACT NO. C8811		DATE 6/16/17 P.E. STAMP BOX								OF		
DESIGNED BY J. TURCOTT	REV. 0 - RFC	6/16/17		DATE 01/27/17 BY				DRAINAGE DETAILS	SHEETS							
ENTERED BY E. JACKSON	REV. B - FINAL REVIEW	4/14/17														
CHECKED BY J. ZIGWEID	REV. A - PRELIMINARY REVIEW															
PROJ. ENGR. C. CHEN	REVISION	DATE	BY													
REGIONAL ADM. L. ENG																

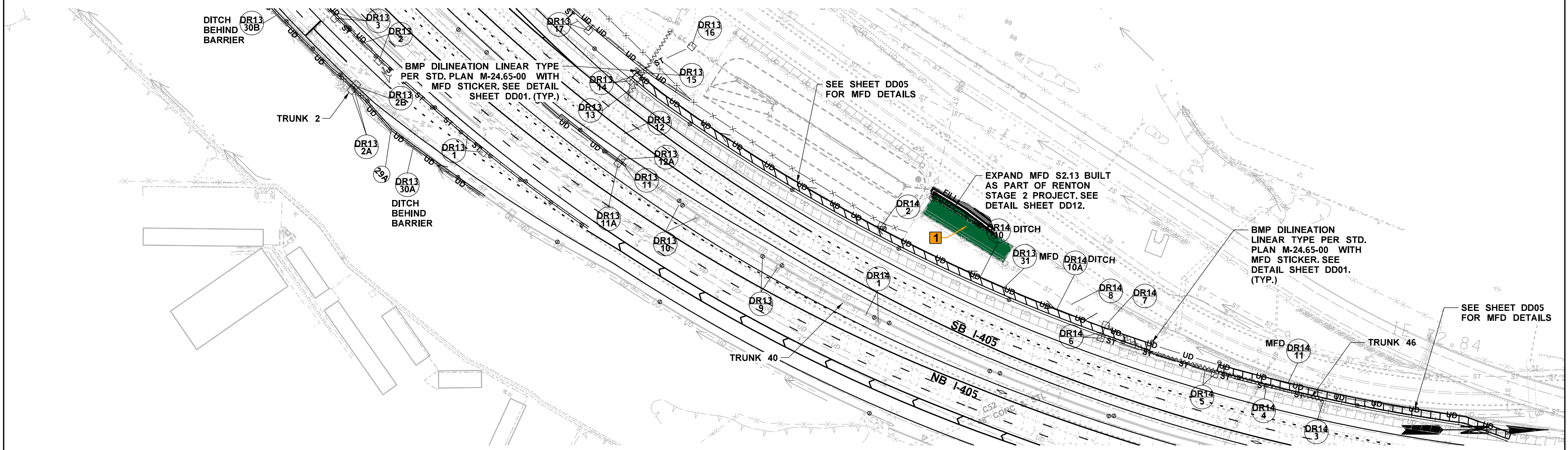




SITE INFORMATION	
LOCATION:	I-405 MP 2.9 TO MP 3.1
FACILITY TYPE:	MEDIA FILTER DRAIN
MAINTENANCE RESPONSIBILITY:	WSDOT
DESIGN:	OL-XXXX   CONSTRUCTION: 01XXXX   JOB NUMBER: XXXX
HYDRAULIC REPORT	TBD
MODIFIED BY:	N/A
SITE DESCRIPTION:	THIS IS A MODIFIED MEDIA FILTER DRAIN PROVIDING ENHANCED WATER QUALITY. THE MEDIA FILTER DRAIN WAS ORIGINALLY CONSTRUCTED AS PART OF THE RENTON STAGE 2 PROJECT. THE MEDIA FILTER DRAIN WAS EXPANDED BY THE I-405/SR 167 DIRECT CONNECTOR PROJECT.
AS-BUILT FIELD VERIFICATION:	N/A
SURVEY BENCH MARK:	TBD
FEATURE ANOMALIES:	N/A
DISCLAIMER:	NOTIFY MAINTENANCE SUPERVISOR IF THE BMP IS NOT CHARACTERISTIC OF THIS OWNER'S MANUAL TO FACILITATE MAINTENANCE ACTIVITIES. CONTACT MAINTENANCE SUPERINTENDENT BEFORE ANY MAINTENANCE TAKES PLACE.
DIRECTIONS:	







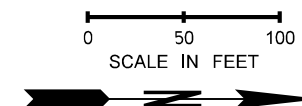
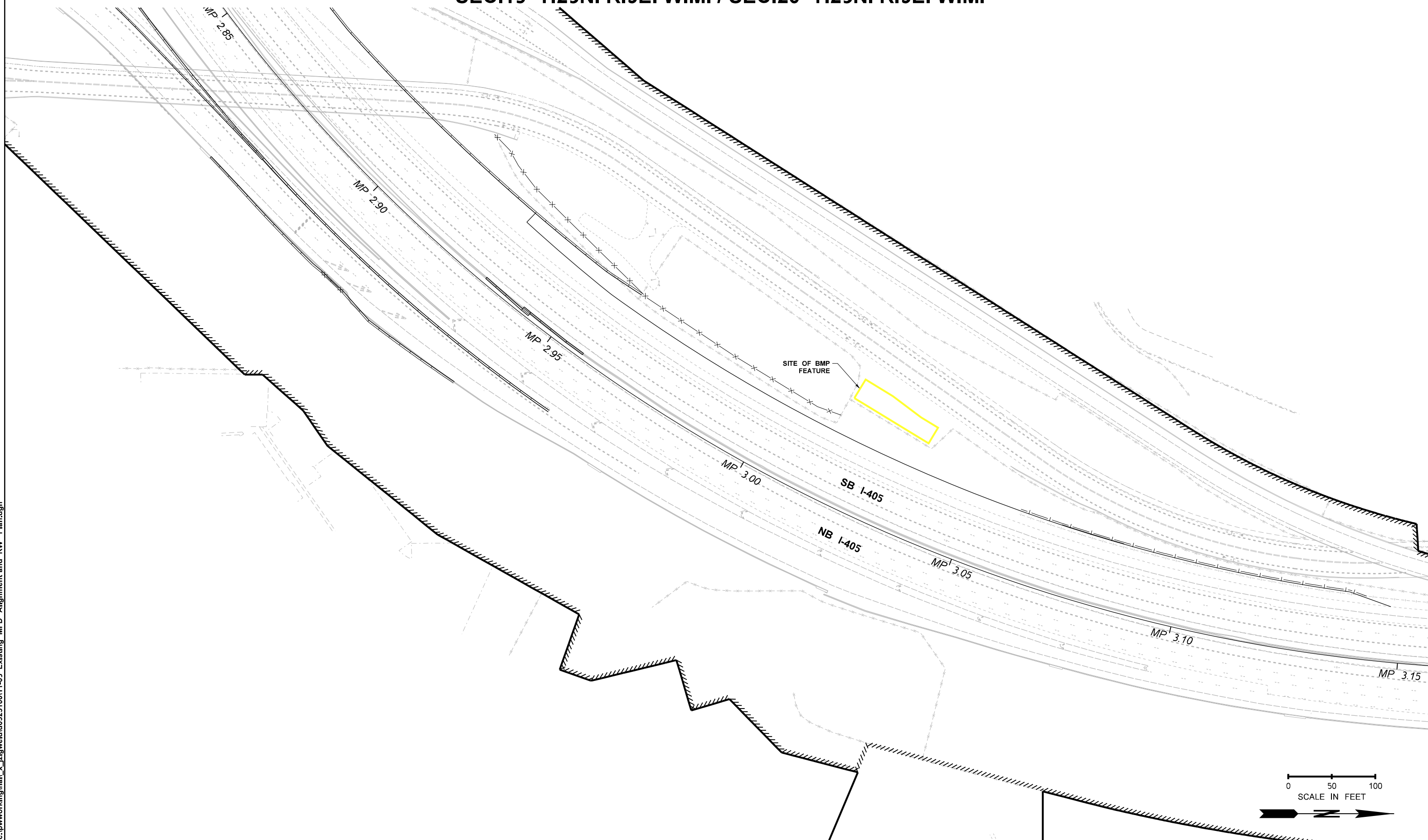
NO.	ITEM	PURPOSE
1	MEDIA FILTER DRAIN MIX	PROVIDE ENHANCED WATER QUALITY TREATMENT.

NO.	ITEM	BMP MAINTENANCE ACTIVITY
NOTE: THE FOLLOWING ITEMS SUPPLEMENT HRM TABLES 5-12 THROUGH 5-24. REFER TO TABLES 5-12 THROUGH 5-24 FOR GENERAL MAINTENANCE ACTIVITIES.		
1	MEDIA FILTER DRAIN MIX	REFER TO HRM TABLES 5-12 THROUGH 5-24.

LEGEND	
	- DRAINAGE STRUCTURE ID CONTINUED
	- STORM SEWER PIPE
	- CATCH BASIN
	- ROCK OUTFALL PROTECTION
	- MEDIA FILTER DRAIN
	- EXISTING STORM TO BE REMOVED OR ABANDONED



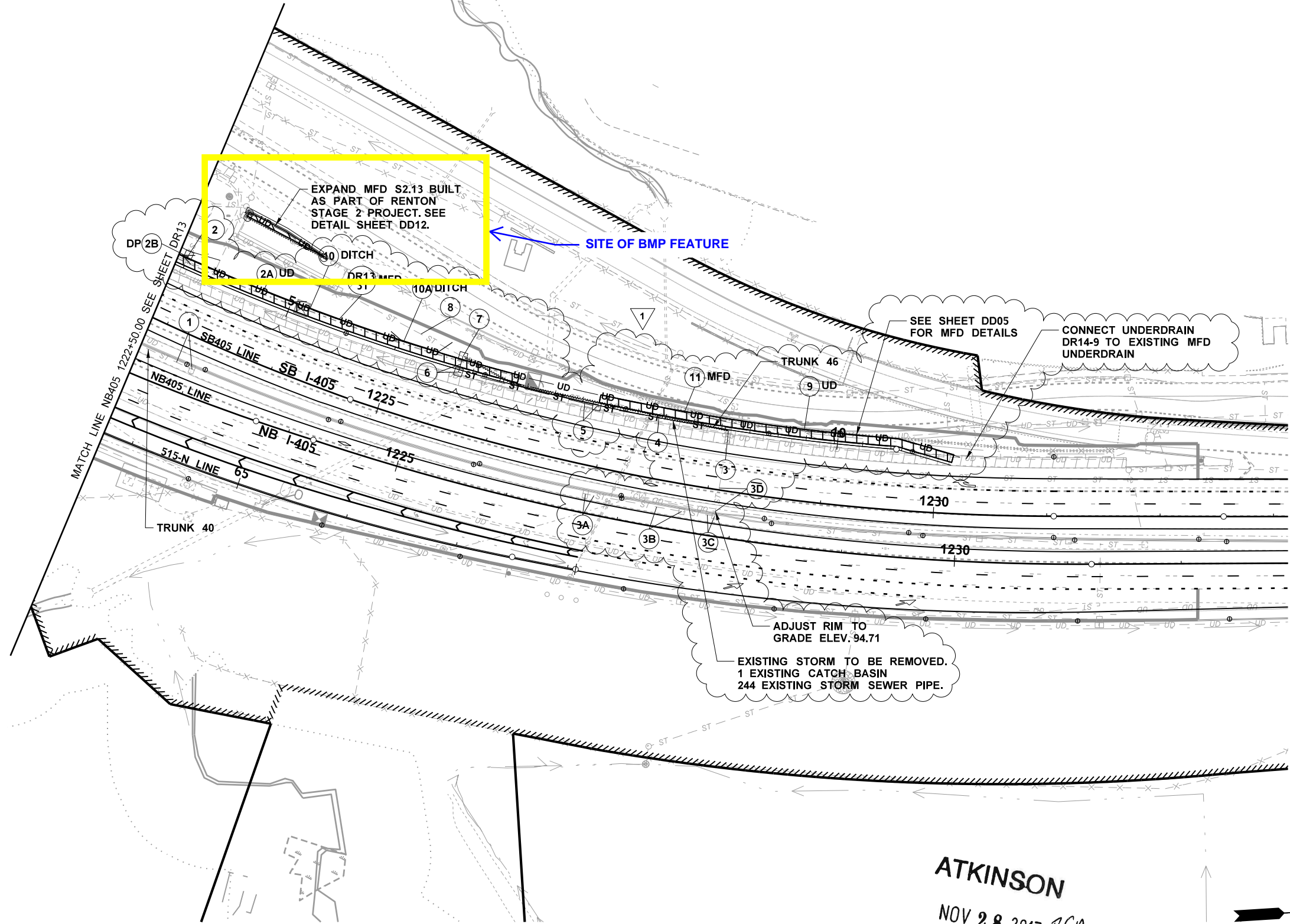
SEC.19 T.23N. R.5E. W.M. / SEC.20 T.23N. R.5E. W.M.





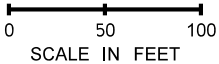
SEC.20 T.23N. R.5E. W.M. / SEC.17 T.23N. R.5E. W.M.



DRAINAGE REFERENCE SUMMARY	
DESCRIPTION	PROFILE/DETAIL SHEET(S)
TRUNK 40	DP21
TRUNK 46	DP24
DRAIN PIPE DR14-2B	DP56



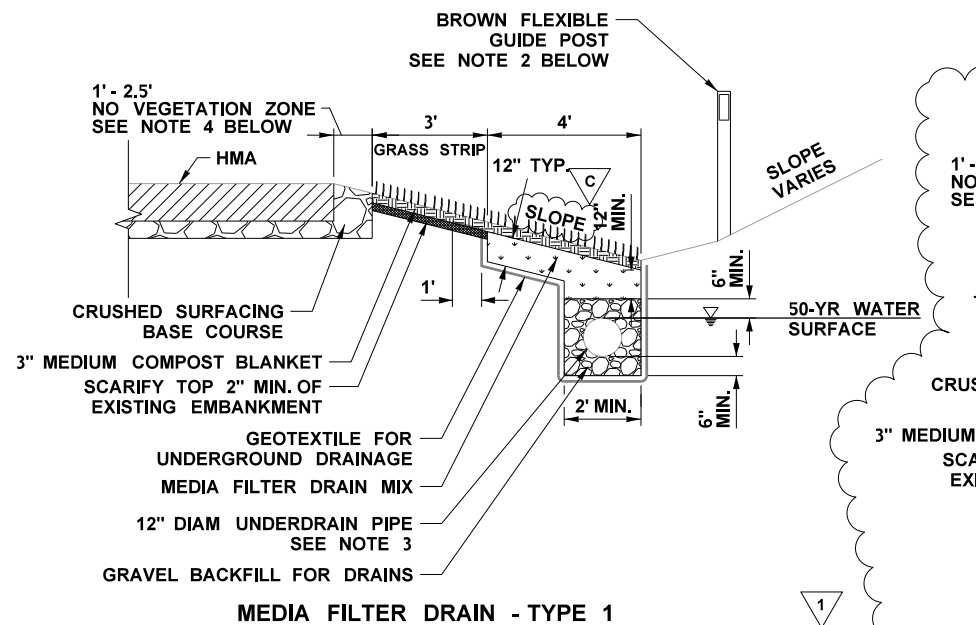
ATKINSON  
NOV 28 2017  
RELEASED FOR CONSTRUCTION

LEGEND	
①	- DRAINAGE STRUCTURE ID
DR01 1	- DRAINAGE STRUCTURE ID CONTINUED
— ST —	- STORM SEWER PIPE
— UD —	- UNDERDRAIN PIPE
— DP —	- DRAIN PIPE
□	- CATCH BASIN
▣	- GRATE INLET
▤	- DROP INLET
○	- MANHOLE
▣	- ROCK OUTFALL PROTECTION
→	- DRAINAGE DITCH
~	- COMPOST AMENDED BIOFILTRATION SWALE
▨	- MEDIA FILTER DRAIN
~~~~~	- EXISTING STORM TO BE REMOVED OR ABANDONED

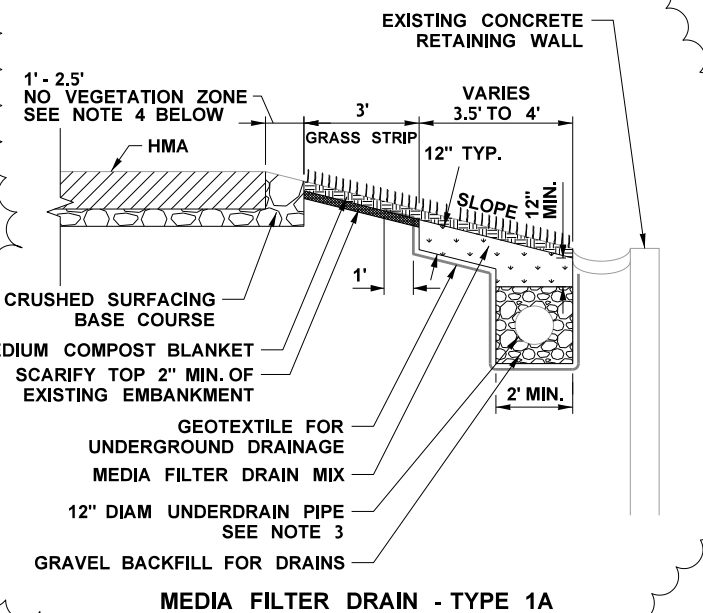


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TIME 3:35:30 PM						DR14											
DATE 11/27/2017						REGION NO. 10		STATE WASH		FED.AID PROJ.NO.						SHEET	
PLOTTED BY JZigweid		REV. 1 - RFC RFI0181		11/27/17													
DESIGNED BY J. TURCOTT		REV. C - FINAL REVIEW		11/3/17				JOB NUMBER		LOCATION NO.						OF	
ENTERED BY E. JACKSON		REV. 0 - RFC		6/16/17													
CHECKED BY J. ZIGWEID		REV. B - FINAL REVIEW		4/14/17				CONTRACT NO.		C8811						SHEETS	
PROJ. ENGR. C. CHEN		REV. A - PRELIMINARY REVIEW		1/27/17													
REGIONAL ADM. L. ENG		REVISION		DATE		BY											

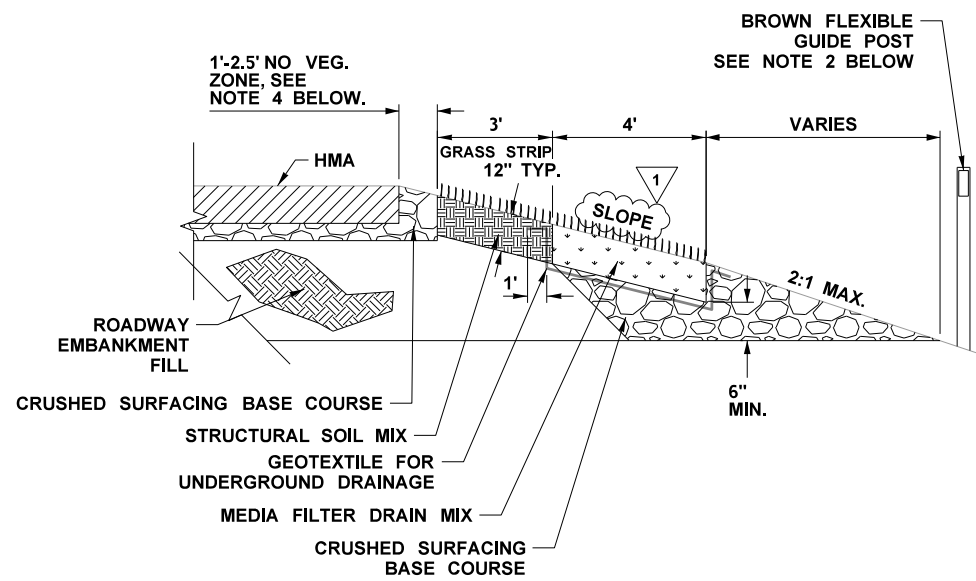




**MEDIA FILTER DRAIN - TYPE 1**



**MEDIA FILTER DRAIN - TYPE 1A**



**MEDIA FILTER DRAIN - TYPE 3**

**MEDIA FILTER DRAIN DETAILS**  
N.T.S.

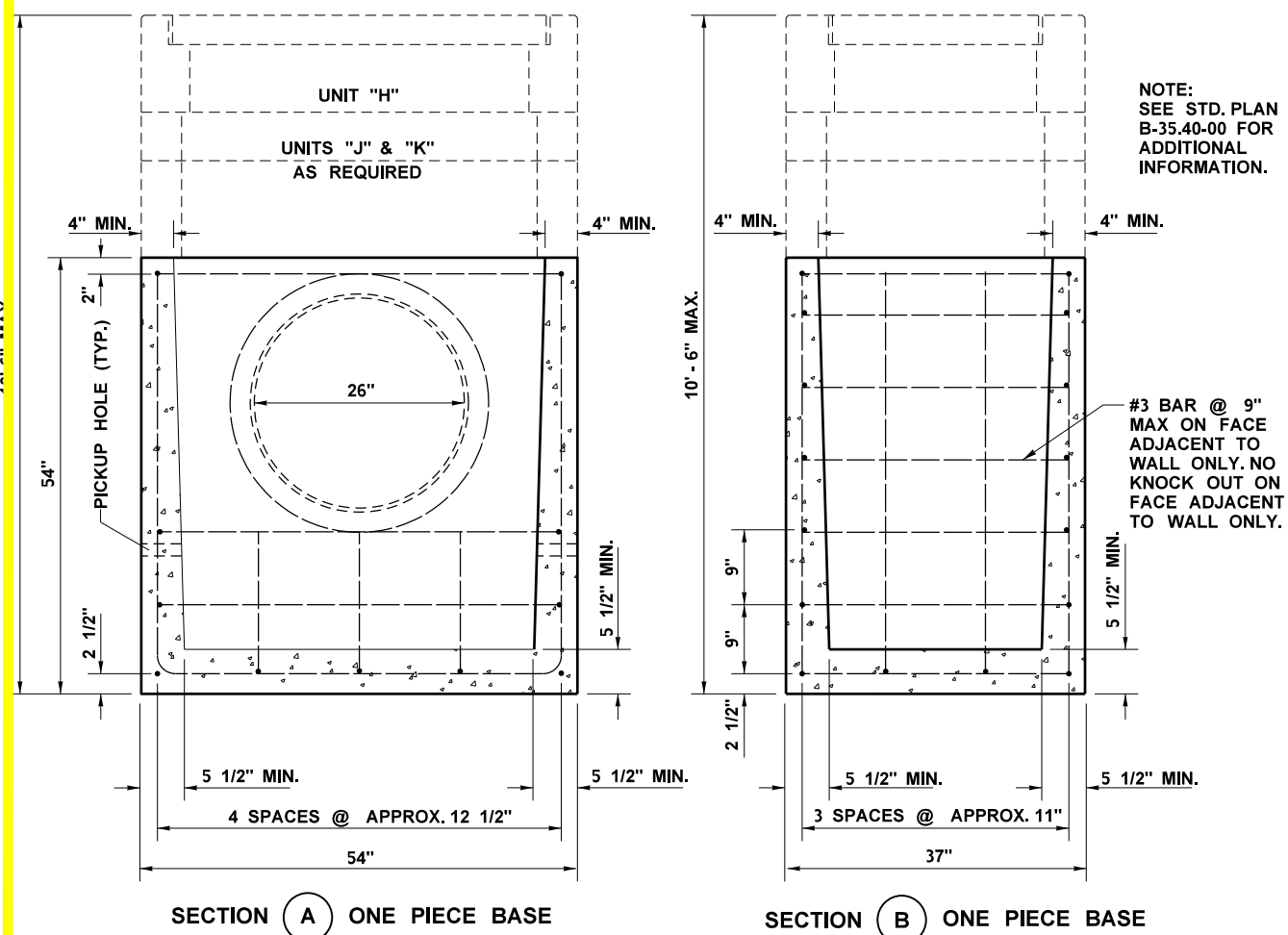
**MEDIA FILTER DRAIN TABLE**

STRUCTURE NOTE	START STATION	START OFFSET	END STATION	END OFFSET	LENGTH (LF)	SLOPE (H:V)	TYPE
DR07-4	NB167 323+25.26	36.42' RT	NB167 334+45.54	38.27' RT	1,120	4:1	3
DR07-7	NB167 318+04.40	35.00' RT	NB167 319+73.37	35.00' RT	169	4:1	3
DR13-31	SB405 1219+75.21	50.00' LT	SB405 1225+45.60	56.50' LT	570	4:1	1
DR13-31	SB405 1225+45.60	56.50' LT	SB405 1226+13.50	56.50' LT	68	6:1	1
DR14-11	SB405 1226+90.00	56.50' LT	SB405 1227+23.50	64.50' LT	34	6:1	1
DR14-11	SB405 1227+23.50	64.50' LT	SB405 1230+13.86	45.00' LT	290	6:1	1A

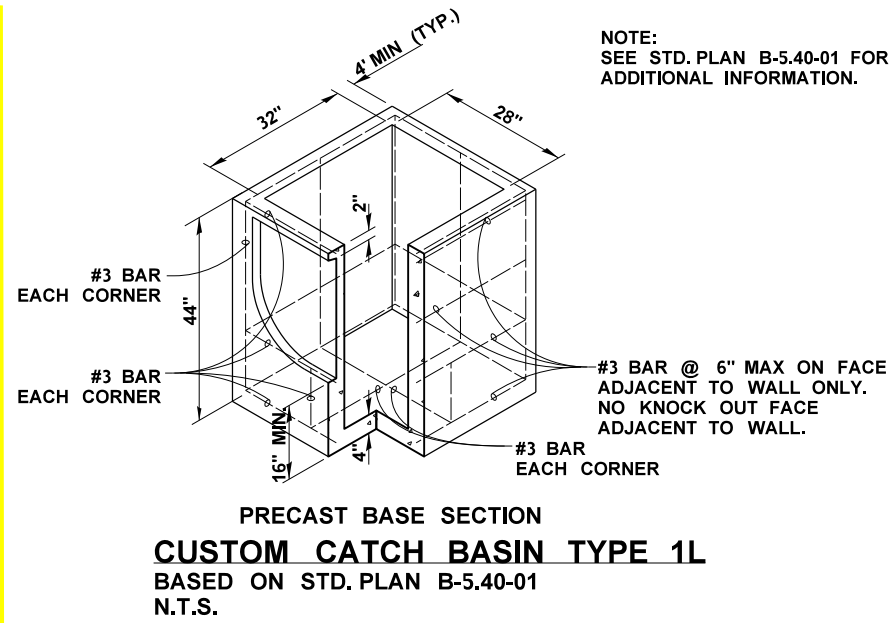
ATKINSON  
NOV 28 2017  
RELEASED FOR CONSTRUCTION

**MFD NOTES:**

- REFER TO ROADWAY SECTIONS FOR SIDE SLOPE GEOMETRY. WIDTH OF NO VEGETATION ZONE VARIES TO ACCOMMODATE GUARDRAIL INSTALLATIONS.
- INSTALL FLEXIBLE GUIDE POSTS (WITH NON-RELECTIVE SHEETING) AT THE BEGINNING AND END OF THE MEDIA FILTER DRAIN RUN AND ALONG THE LENGTH OF THE MEDIA FILTER DRAIN AT 500 FOOT SPACING (MAX). WHERE COINCIDENT WITH GUARDRAIL, GUIDE POST SHALL BE MOUNTED TO GUARDRAIL PER STD. PLAN M-40.10-03.
- PROVIDE A CLEANOUT AT THE UPSTREAM END OF THE UNDERDRAIN. THIS CLEANOUT MAY BE A 90° ELBOW EQUAL IN DIAMETER TO THE UNDERDRAIN WITH REMOVABLE CAP AT GRADE OR CATCH BASIN TYPE 1. PROVIDE CLEANOUTS AT 300' MAX. SPACING ALONG THE UNDERDRAIN AND AT JUNCTIONS. THESE CLEANOUTS MAY BE A TEE FITTING EQUAL IN DIAMETER TO THE UNDERDRAIN WITH REMOVABLE CAP AT GRADE OR CATCH BASIN TYPE 1.
- NO VEGETATION ZONE FOR MFD SHALL BE 1' EXCEPT AT GUARDRAILS IT SHALL BE 2.5'.
- SEE MEDIA FILTER DRAIN SPECIFICATION ON SHEET DD06.

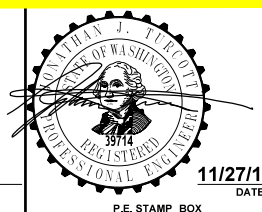


**CUSTOM GRATE INLET TYPE 2 ROTATED**  
BASED ON STD. PLAN B-35.40-00  
N.T.S.



**PRECAST BASE SECTION**  
**CUSTOM CATCH BASIN TYPE 1L**  
BASED ON STD. PLAN B-5.40-01  
N.T.S.

FILE NAME	c:\pwworking\inat_x_jzigweid\0521992\08811_DE_DD05.dgn	REGION NO.	10	STATE	WASH	FED.AID PROJ.NO.	
TIME	3:45:35 PM						
DATE	11/27/2017						
PLOTTED BY	JZigweid	REV. 1 - RFC	RFI0181	11/27/17			
DESIGNED BY	J. TURCOTT	REV. C - FINAL REVIEW		11/3/17			
ENTERED BY	E. JACKSON	REV. 0 - RFC		6/16/17			
CHECKED BY	J. ZIGWEID	REV. B - FINAL REVIEW		4/14/17			
PROJ. ENGR.	C. CHEN	REV. A - PRELIMINARY REVIEW		1/27/17			
REGIONAL ADM.	L. ENG	REVISION		DATE	BY	C8811	



I-405 / SR 167 INTERCHANGE DIRECT CONNECTOR	PLAN REF NO DD05
DRAINAGE DETAILS	SHEET OF SHEETS



MEDIA FILTER DRAIN SPECIFICATION

DESCRIPTION

SECTION 7-01.1 IS SUPPLEMENTED WITH THE FOLLOWING:

THIS WORK SHALL CONSIST OF CONSTRUCTING MEDIA FILTER DRAINS AND PLACING COMPOST.

REFER TO SHEET DD05 FOR TYPICAL MEDIA FILTER DRAIN CONFIGURATIONS.

MATERIALS

SECTION 7-01.2 IS SUPPLEMENTED WITH THE FOLLOWING:

MEDIUM COMPOST 9-14.4(8)  
GEOTEXTILE FOR UNDERGROUND DRAINAGE 9-33

MEDIA FILTER DRAIN

MEDIA FILTER DRAIN MIX

MEDIA FILTER DRAIN MIX SHALL BE MIXED IN THE FOLLOWING PROPORTIONS: 3 CUBIC YARDS OF AGGREGATE, 1 CUBIC YARD OF HORTICULTURAL GRADE PERLITE, 40 POUNDS OF AGRICULTURAL GRADE DOLOMITE, AND 12 POUNDS OF AGRICULTURAL GRADE GYPSUM. MEDIA FILTER DRAIN MIX SHALL BE PREMIXED PRIOR TO PLACEMENT. THE SOIL AMENDMENTS AND AGGREGATE SHALL MEET THE FOLLOWING REQUIREMENTS PRIOR TO MIXING:

AGGREGATE FOR MEDIA FILTER DRAIN MIX

AGGREGATE FOR MEDIA FILTER DRAIN MIX SHALL MEET ALL REQUIREMENTS FOR SECTION 9-03.4 AGGREGATE FOR BITUMINOUS SURFACE TREATMENT - CRUSHED SCREENINGS 3/8-INCH TO NO. 4 EXCEPT THE FRACTURE REQUIREMENT SHALL BE AT LEAST TWO FRACTURED FACES AND WILL APPLY TO MATERIAL RETAINED ON THE U.S. NO. 4 SIEVE IN ACCORDANCE WITH FOP FOR AASHTO T 335.

HORTICULTURAL GRADE PERLITE

HORTICULTURAL GRADE PERLITE SHALL BE PER SECTION 9-14.4(9), MEET THE FOLLOWING GRADING REQUIREMENTS, AND NOT CONTAIN ANY TOXIC MATERIAL:

SIEVE SIZE	% PASSING
NO. 4	99% - 100%
NO. 18	0% - 30%
NO. 30	0% - 10%

AGRICULTURAL GRADE DOLOMITE

AGRICULTURAL GRADE DOLOMITE SHALL BE PER SECTION 9-14.4(5) AND MEET THE REQUIREMENTS OF ASTM C 602 CLASS DESIGNATION E.

AGRICULTURAL GRADE GYPSUM

AGRICULTURAL GRADE GYPSUM SHALL BE PER SECTION 9-14.4(6) AND MEET THE FOLLOWING GRADING REQUIREMENTS:

SIEVE SIZE	% PASSING
1/4-INCH	99% - 100%
NO. 20	0% - 20%

THE ACCEPTANCE OF THE AGGREGATE SHALL BE BASED ON A SATISFACTORY TEST REPORT FOR EVERY 1000 TONS. TESTING OF AGGREGATE SHALL OCCUR PRIOR TO MIXING WITH THE SOIL AMENDMENTS. HORTICULTURAL GRADE PERLITE, AGRICULTURAL GRADE DOLOMITE AND GYPSUM WILL BE ACCEPTED BY CATALOG CUT OR BAG LABEL.

THE FINISHED PRODUCT SHALL BE CLEAN, UNIFORMLY MIXED, AND FREE FROM WOOD, BARK, ROOTS, AND OTHER DELETERIOUS MATERIALS.

STRUCTURAL SOIL MIX

THE STRUCTURAL SOIL MIX FOR THE GRASS STRIP SHALL CONSIST OF A UNIFORM BLEND COMPOSED BY VOLUME OF 70% TO 80% AGGREGATE, 20% TO 30% COMPOST. 100% OF THE MIXTURE SHALL PASS THROUGH A 2-1/2 INCH SIEVE.

COMPOST

COMPOST SHALL BE MEDIUM COMPOST AND MEET THE MATERIAL REQUIREMENTS AS SPECIFIED IN SECTION 9-14.4(8).

AGGREGATE

AGGREGATE SHALL CONSIST OF BALLAST IN ACCORDANCE WITH SECTION 9-03.9(1).

MIXING REQUIREMENTS

THE CONTRACTOR SHALL SUBMIT THE PROPOSED METHOD OF MIXING IN WRITING FOR THE ENGINEER'S APPROVAL. NO MIXING SHALL TAKE PLACE WITHOUT WRITTEN APPROVAL FROM THE ENGINEER.

STRUCTURAL SOIL MIX SHALL BE THOROUGHLY MIXED PRIOR TO BEING PLACED.

CONSTRUCTION REQUIREMENTS

SECTION 7-01.3 IS SUPPLEMENTED WITH THE FOLLOWING:

MEDIA FILTER DRAIN

THE CONTRACTOR SHALL CONSTRUCT THE MEDIA FILTER DRAIN IN ACCORDANCE WITH THE DETAILS IN THE PLANS.

THE CONTRACTOR SHALL CONDUCT THE INSTALLATION OF THE MEDIA FILTER DRAIN SUCH THAT THE DIFFERENT SECTIONS OF THE MEDIA FILTER DRAIN ARE NOT CONTAMINATED OR DISPLACED BY OTHER MATERIALS DURING INSTALLATION.

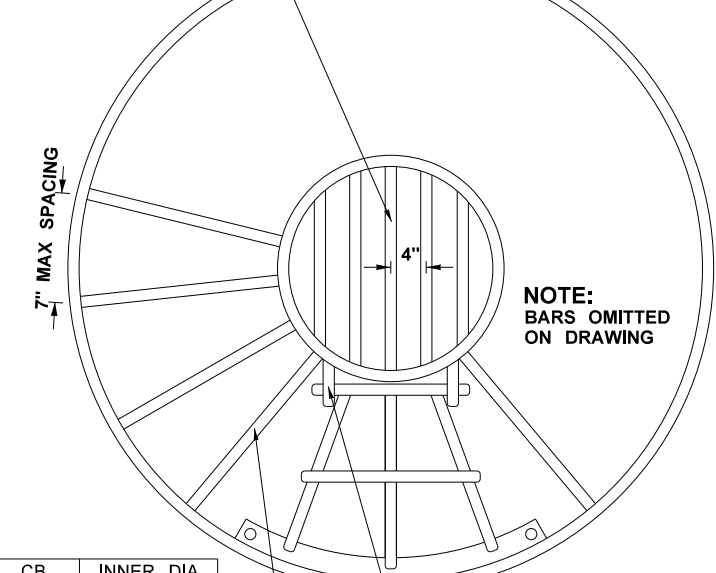
THE CONTRACTOR SHALL NOT SEED, FERTILIZE OR MULCH THE MEDIA FILTER DRAIN MIX.

ONCE INSTALLED, THE CONTRACTOR WILL NOT BE ALLOWED TO DRIVE EQUIPMENT OVER THE AREA OF THE MEDIA FILTER DRAIN.

MEDIA FILTER DRAIN EXCAVATION SHALL CONFORM TO SECTION 2-09.3(4). EXCAVATED MATERIAL SUITABLE FOR USE IN EMBANKMENT MAY BE USED AT THE DISCRETION OF THE ENGINEER. OTHERWISE, THE MATERIAL EXCAVATED SHALL BECOME PROPERTY OF THE CONTRACTOR.

THE CONTRACTOR SHALL PLACE THE STRUCTURAL SOIL MIX IN LAYERS NO MORE THAN 5-INCHES IN DEPTH BEFORE COMPACTION. EACH LAYER SHALL BE COMPACTED BY THREE PASSES OF A VIBRATORY PLATE COMPACTOR. AFTER PLACEMENT AND COMPACTION OF STRUCTURAL SOIL MIX, MEDIUM COMPOST SHALL BE PLACED TO A DEPTH OF TWO INCHES PRIOR TO SEEDING, FERTILIZING AND MULCHING.

3/4" DIA SMOOTH ROUND BARS EQUALLY SPACED (4" O.C. MAX)

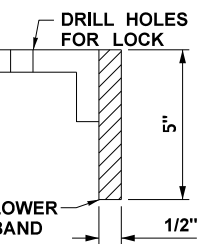
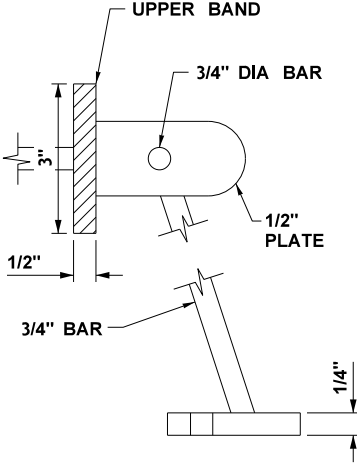


CB	INNER DIA
48"	58"
54"	65"
60"	72"
72"	86"
96"	114"

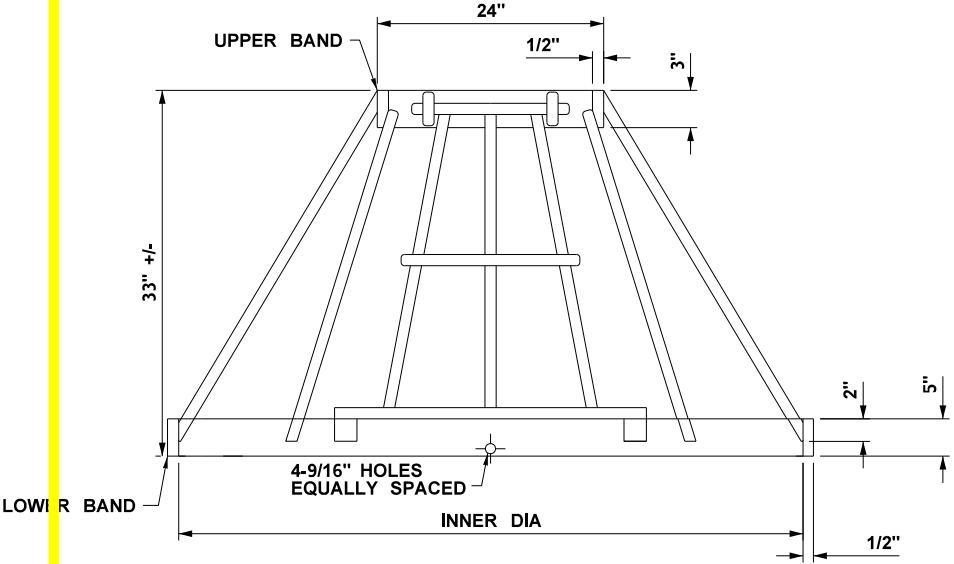
HINGE, SEE DETAIL

3/4" DIA SMOOTH ROUND BARS EQUALLY SPACED. BARS SHALL BE WELDED TO UPPER & LOWER BANDS.

PLAN VIEW



HINGE DETAIL




ELEVATION VIEW

NOTE:  
ALL PARTS MUST BE EITHER ALUMINUM OR STAINLESS STEEL. NO GALVANIZED MATERIAL TO BE USED.

DEBRIS CAGE

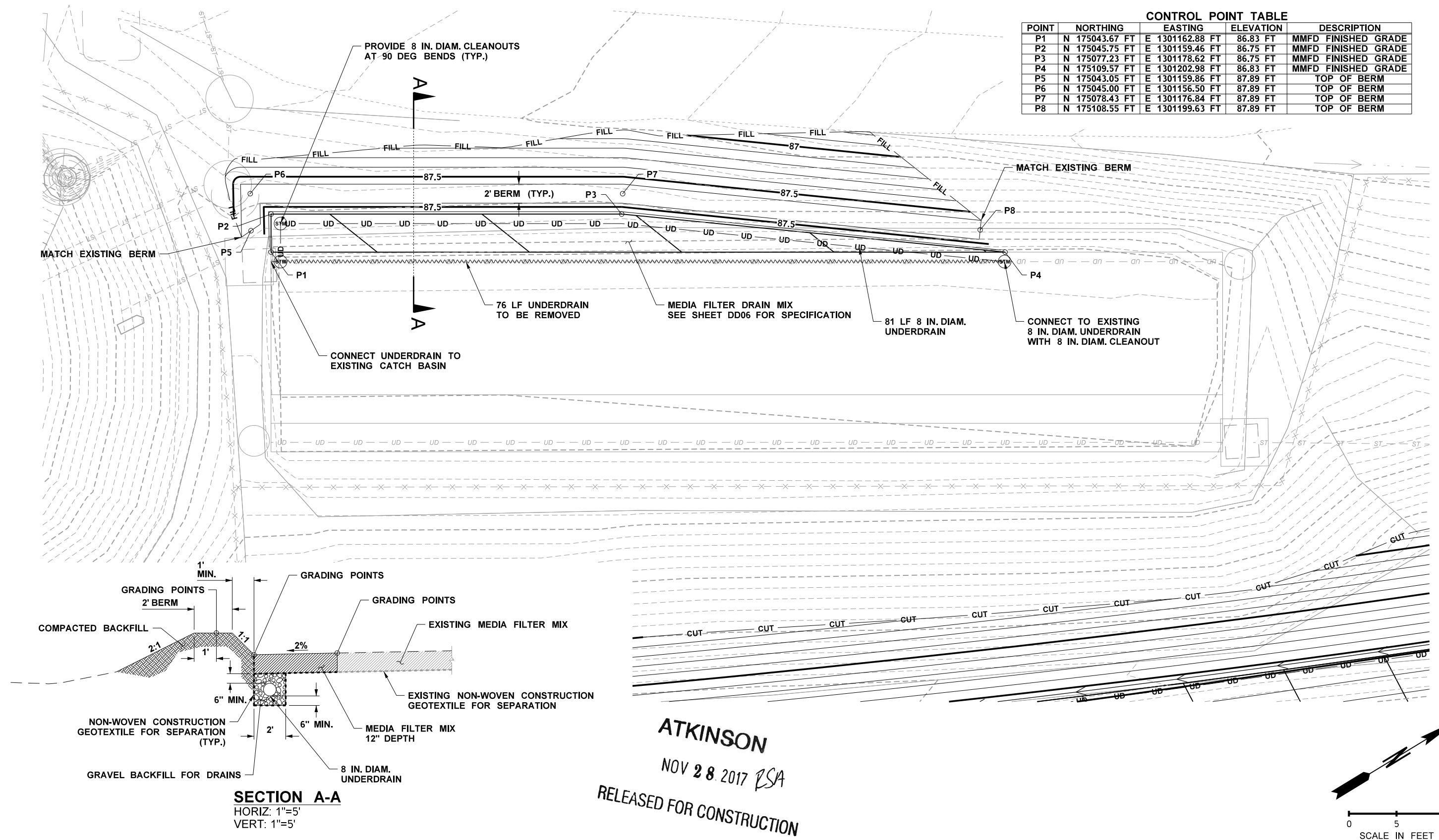
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FILE NAME c:\pwworking\inai_x_ejackson\0321992\C8811_DE_DD06.dgn										PLAN REF NO DD06																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
TIME 12:35:40 PM								REGION NO. 10		STATE WASH		FED.AID PROJ.NO.				DATE 6/16/17		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE		DATE	



## SEC.19 T.23N. R.5E. W.M.

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
P1	N 175043.67 FT	E 1301162.88 FT	86.83 FT	MMFD FINISHED GRADE
P2	N 175045.75 FT	E 1301159.46 FT	86.75 FT	MMFD FINISHED GRADE
P3	N 175047.23 FT	E 1301178.62 FT	86.75 FT	MMFD FINISHED GRADE
P4	N 175109.57 FT	E 1301202.98 FT	86.83 FT	MMFD FINISHED GRADE
P5	N 175043.05 FT	E 1301159.86 FT	87.89 FT	TOP OF BERM
P6	N 175045.00 FT	E 1301156.50 FT	87.89 FT	TOP OF BERM
P7	N 175108.43 FT	E 1301176.84 FT	87.89 FT	TOP OF BERM
P8	N 175108.55 FT	E 1301199.63 FT	87.89 FT	TOP OF BERM

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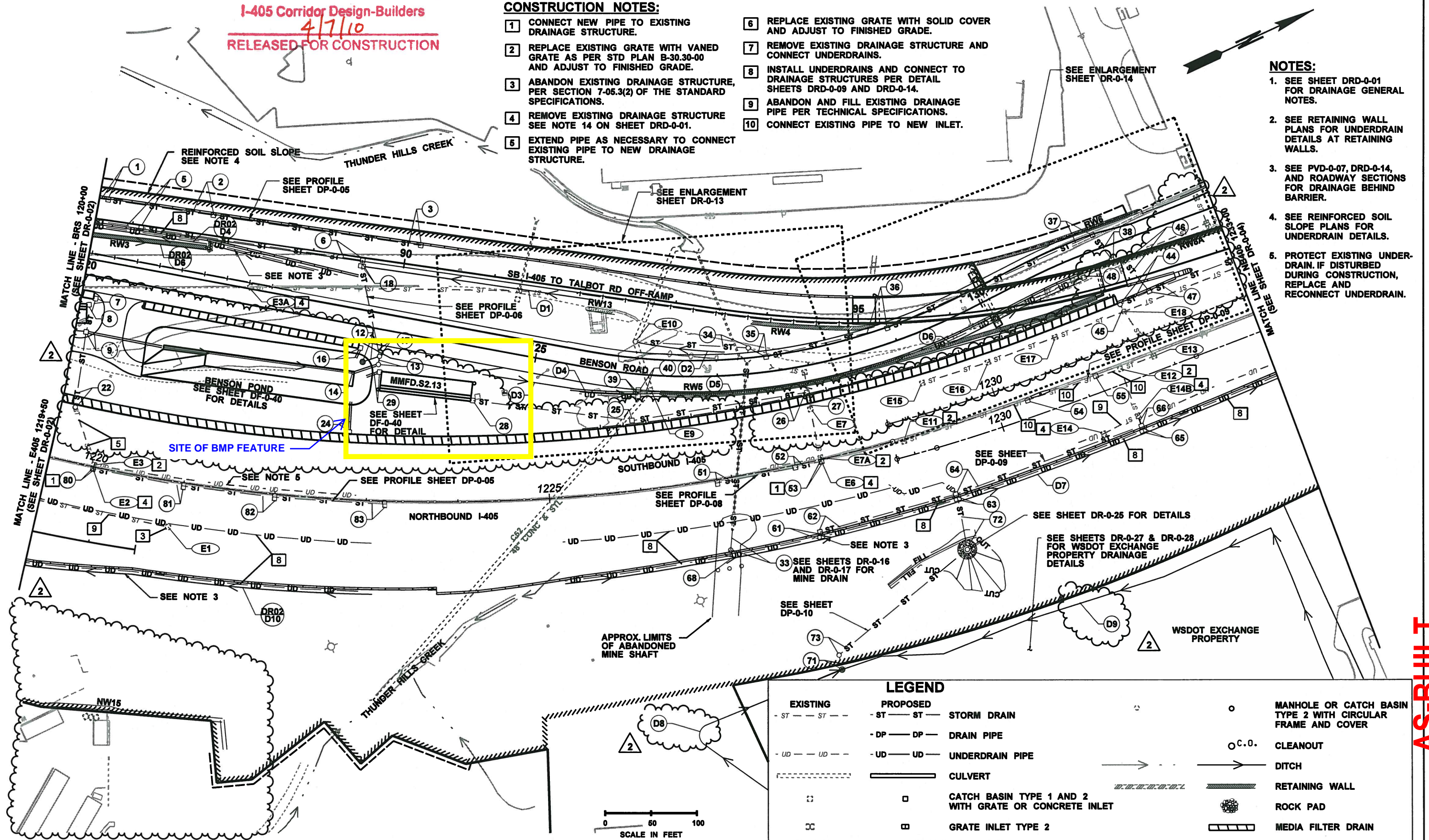
I-405 Corridor Design-Builders  
4/17/10  
RELEASED FOR CONSTRUCTION

#### CONSTRUCTION NOTES:

- 1 CONNECT NEW PIPE TO EXISTING DRAINAGE STRUCTURE.
- 2 REPLACE EXISTING GRATE WITH VANED GRATE AS PER STD PLAN B-30.30-00 AND ADJUST TO FINISHED GRADE.
- 3 ABANDON EXISTING DRAINAGE STRUCTURE, PER SECTION 7-05.3(2) OF THE STANDARD SPECIFICATIONS.
- 4 REMOVE EXISTING DRAINAGE STRUCTURE SEE NOTE 14 ON SHEET DRD-0-01.
- 5 EXTEND PIPE AS NECESSARY TO CONNECT EXISTING PIPE TO NEW DRAINAGE STRUCTURE.
- 6 REPLACE EXISTING GRATE WITH SOLID COVER AND ADJUST TO FINISHED GRADE.
- 7 REMOVE EXISTING DRAINAGE STRUCTURE AND CONNECT UNDERDRAINS.
- 8 INSTALL UNDERDRAINS AND CONNECT TO DRAINAGE STRUCTURES PER DETAIL SHEETS DRD-0-09 AND DRD-0-14.
- 9 ABANDON AND FILL EXISTING DRAINAGE PIPE PER TECHNICAL SPECIFICATIONS.
- 10 CONNECT EXISTING PIPE TO NEW INLET.

#### NOTES:

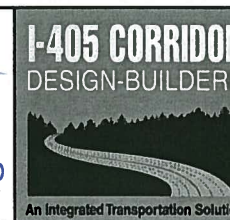
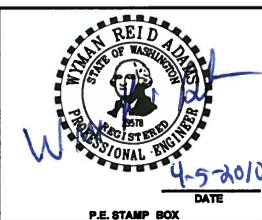
1. SEE SHEET DRD-0-01 FOR DRAINAGE GENERAL NOTES.
2. SEE RETAINING WALL PLANS FOR UNDERDRAIN DETAILS AT RETAINING WALLS.
3. SEE PVD-0-07, DRD-0-14, AND ROADWAY SECTIONS FOR DRAINAGE BEHIND BARRIER.
4. SEE REINFORCED SOIL SLOPE PLANS FOR UNDERDRAIN DETAILS.
5. PROTECT EXISTING UNDERDRAIN IF DISTURBED DURING CONSTRUCTION, REPLACE AND RECONNECT UNDERDRAIN.



NO.	ISSUE DATE	ISSUE RECORD - DESCRIPTION	DESIGNED BY	ENTERED BY	CHECKED BY	DESIGN MANAGER:	REGION NO.	STATE
2	04/02/10	RELEASED FOR CONSTRUCTION - 3D	S. CHRISTOPHERSON	S. TAYLOR	R. ADAMS	J. BAUMAN	10	WASH
E	02/10/10	FINAL DESIGN - 3D	R. CHUNG	S. TAYLOR	R. ADAMS			
1	12/09/09	RELEASED FOR CONSTRUCTION - 2B	R. CHUNG	S. TAYLOR	R. ADAMS			
D	11/11/09	FINAL DESIGN - 2B SUPPLEMENT	R. CHUNG	S. TAYLOR	T. MCCARTHY			
C	10/28/09	FINAL DESIGN - 2B	R. CHUNG	S. TAYLOR	R. ADAMS			
0	09/22/09	RELEASED FOR CONSTRUCTION - 1C	S. CHRISTOPHERSON	S. TAYLOR	T. MCCARTHY			
B	08/21/09	FINAL DESIGN - 1C	S. CHRISTOPHERSON	S. TAYLOR	T. MCCARTHY			
A	06/01/09	PRELIMINARY DESIGN	R. CHUNG	K. LORENTSON	G. CALEY			

DESIGN MANAGER:	DESIGN TASK LEAD:	PACKAGE:
J. BAUMAN	R. ADAMS	RFC - 3D

CONTRACT NO.
7624



I-405 I-5 TO SR 169 STAGE 2 - WIDENING AND SR 515 INTERCHANGE DRAINAGE PLAN	DR-0-03 SHEET 88 OF 123 SHEETS
---	-----------------------------------

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7624\_6\_DR\_1\_03.dwg

AS-BUILT



# CONSTRUCTION NOTES:

- CONNECT NEW PIPE TO EXISTING DRAINAGE STRUCTURE.
- REPLACE EXISTING GRATE WITH VANED GRATE AS PER STD PLAN B-30.30-00 AND ADJUST TO FINISHED GRADE.
- ABANDON EXISTING DRAINAGE STRUCTURE, PER SECTION 7-05.3(2) OF THE STANDARD SPECIFICATIONS.
- REMOVE EXISTING DRAINAGE STRUCTURE SEE NOTE 14 ON SHEET DRD-0-01.
- EXTEND PIPE AS NECESSARY TO CONNECT EXISTING PIPE TO NEW DRAINAGE STRUCTURE.
- REPLACE EXISTING GRATE WITH SOLID COVER AND ADJUST TO FINISHED GRADE.
- REMOVE EXISTING DRAINAGE STRUCTURE AND CONNECT UNDERDRAINS.
- INSTALL UNDERDRAINS AND CONNECT TO DRAINAGE STRUCTURES PER DETAIL SHEETS DRD-0-09 AND DRD-0-14.
- ABANDON AND FILL EXISTING DRAINAGE PIPE PER TECHNICAL SPECIFICATIONS.
- CONNECT EXISTING PIPE TO NEW INLET.

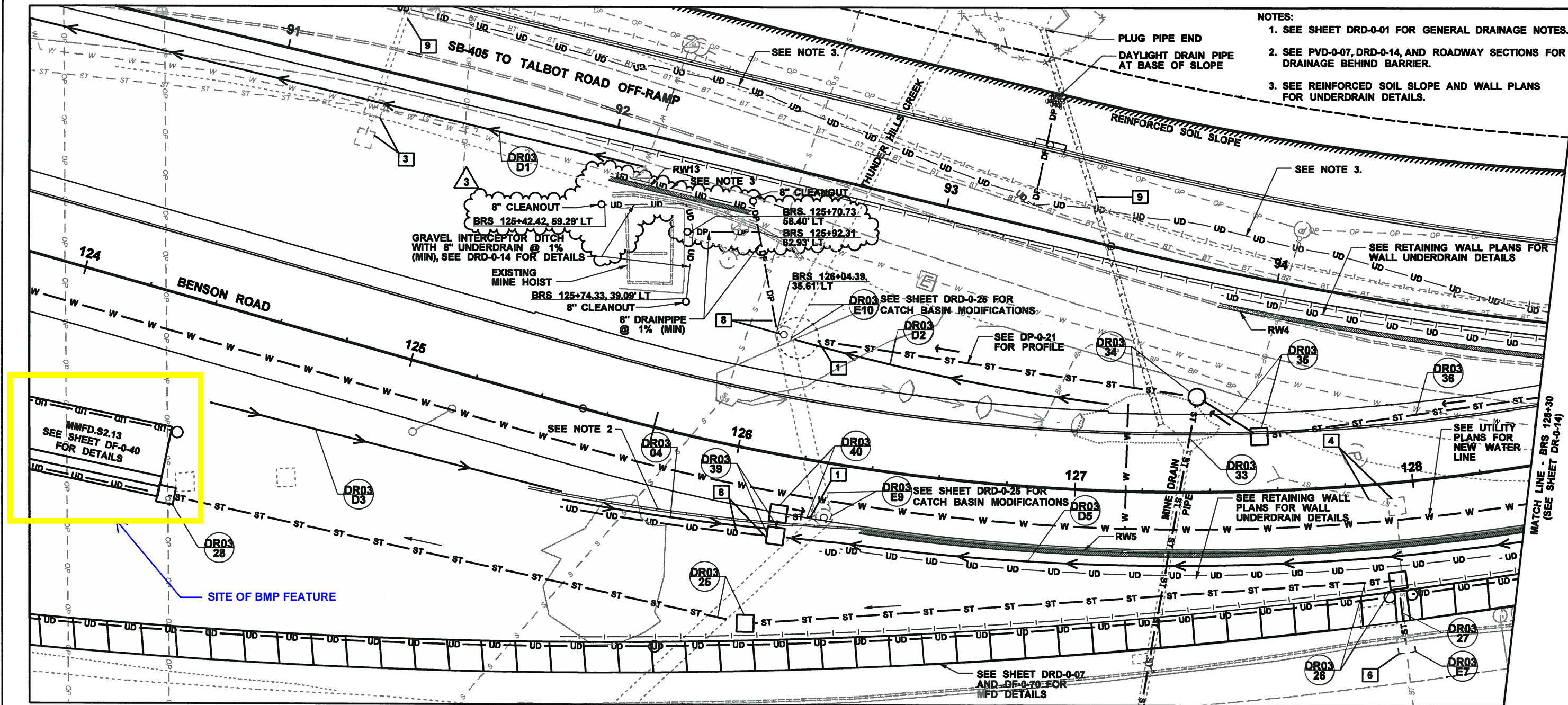
I-405 Corridor Design-Builders  
7/24/10  
RELEASED FOR CONSTRUCTION

0 15 30  
SCALE IN FEET

## LEGEND

EXISTING	PROPOSED		
- ST - - ST - -	- ST - ST -	STORM DRAIN	□ GRATE INLET TYPE 2
- UD - - UD - -	- DP - DP -	DRAIN PIPE	○ MANHOLE OR CATCH BASIN TYPE 2 WITH CIRCULAR FRAME AND COVER
- UD - - UD - -	- UD - UD -	UNDERDRAIN PIPE	○ C.O. CLEANOUT
- - - - -	- - - - -	CULVERT	→ DITCH
□	□	CATCH BASIN TYPE 1 AND 2 WITH GRATE OR CONCRETE INLET	▨ RETAINING WALL
			⊗ ROCK PAD
			▤ MEDIA FILTER DRAIN

- NOTES:
- SEE SHEET DRD-0-01 FOR GENERAL DRAINAGE NOTES.
  - SEE PVD-0-07, DRD-0-14, AND ROADWAY SECTIONS FOR DRAINAGE BEHIND BARRIER.
  - SEE REINFORCED SOIL SLOPE AND WALL PLANS FOR UNDERDRAIN DETAILS.



NO.	ISSUE DATE	ISSUE RECORD - DESCRIPTION	DESIGNED BY	ENTERED BY	CHECKED BY	DESIGN MANAGER:	REGION	STATE	CONTRACT NO.	DATE	PROJECT	SHEET
3	07/20/10	RFI #275	R. ADAMS	K. LORENTSON	R. OYNES	J. BAUMAN	10	WASH			I-405 CORRIDOR DESIGN-BUILDERS	DR-0-13
2	04/02/10	RELEASED FOR CONSTRUCTION - 3D	S. CHRISTOPHERSON	S. TAYLOR	R. ADAMS							
B	02/10/10	FINAL DESIGN - 3D	R. CHUNG	S. TAYLOR	R. ADAMS							
1	01/11/10	RFI #059	R. CHUNG	S. TAYLOR	T. MCCARTHY							
0	12/09/09	RELEASED FOR CONSTRUCTION - 2B	R. CHUNG	S. TAYLOR	R. ADAMS							
A	10/28/09	FINAL DESIGN - 2B	R. CHUNG	S. TAYLOR	R. ADAMS							

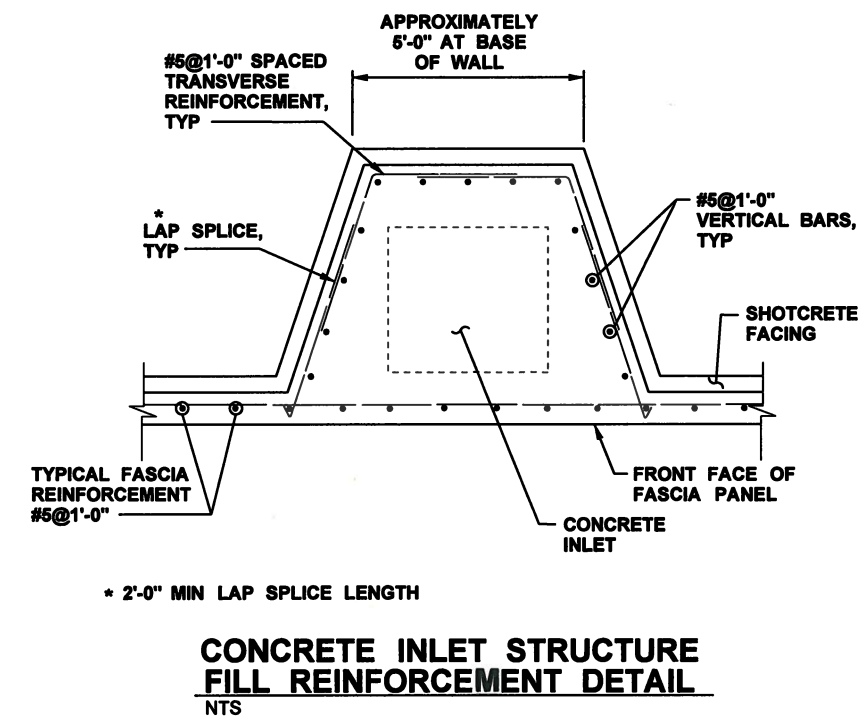
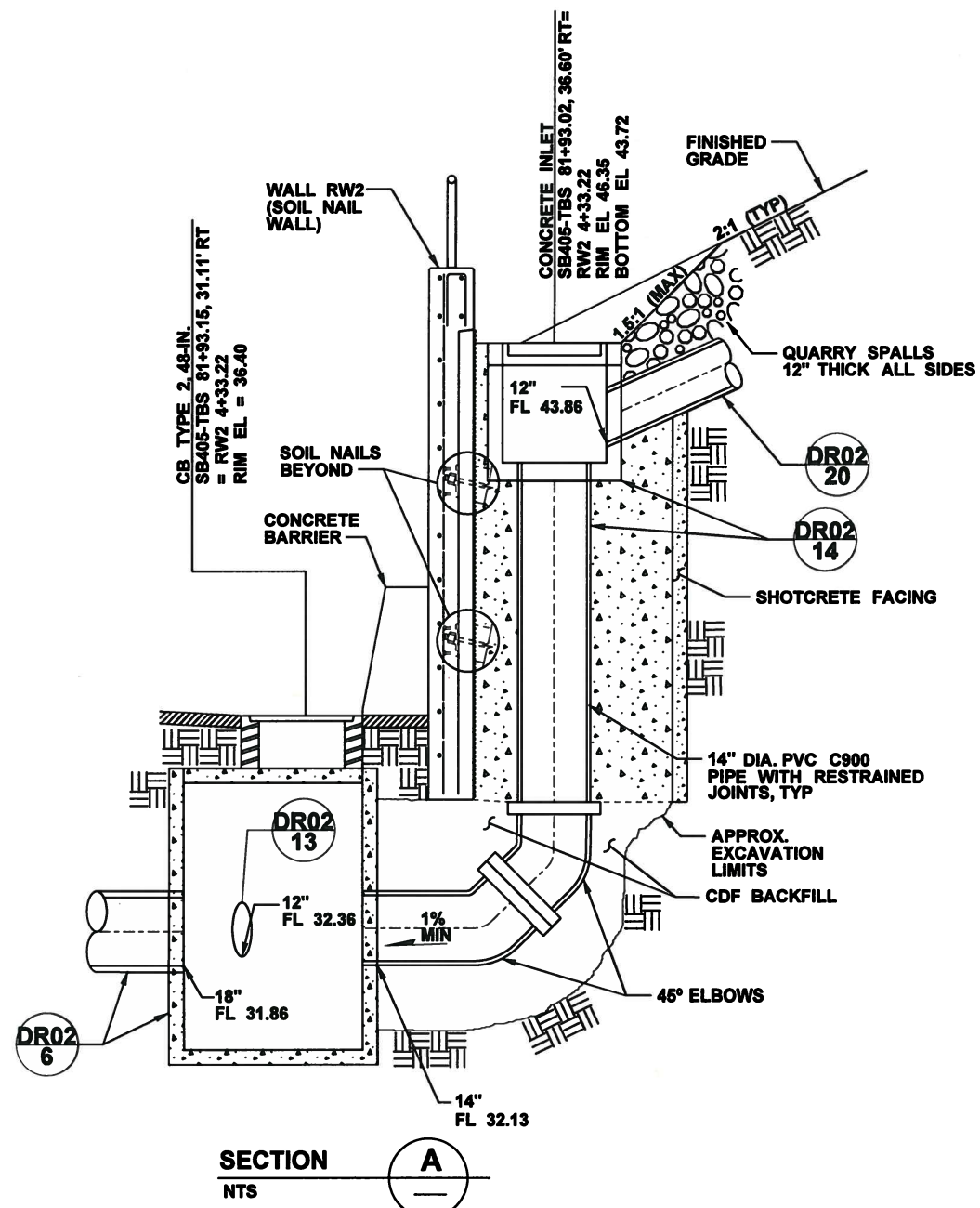
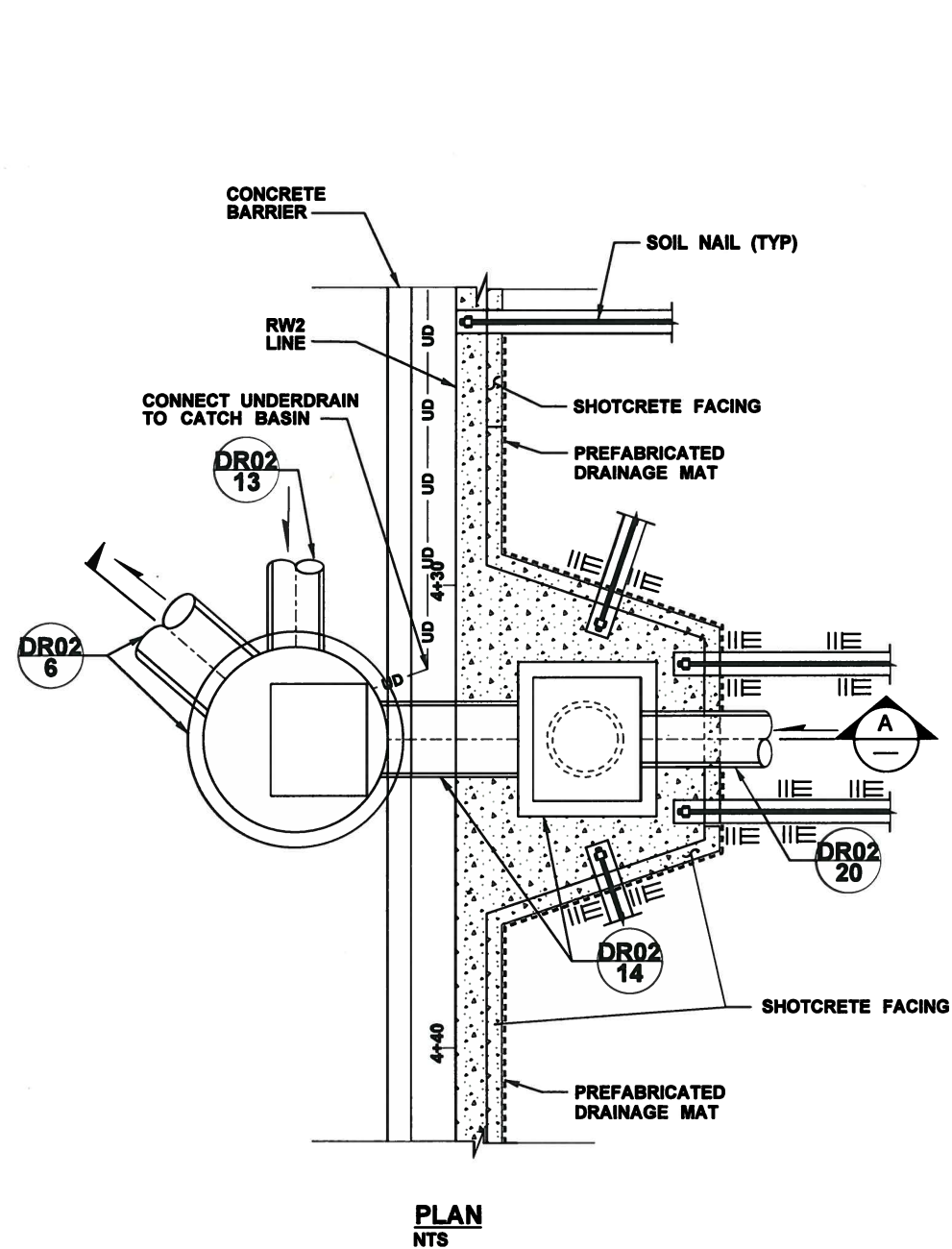
WILLIAM REID ADAMS  
STATE OF WASHINGTON  
PROFESSIONAL ENGINEER  
7-20-2010  
P.E. STAMP BOX

Washington State  
Department of Transportation

I-405  
I-5 TO SR 169  
STAGE 2 - WIDENING  
AND SR 515 INTERCHANGE  
DRAINAGE PLAN ENLARGEMENT  
SOUTHBOUND OFF-RAMP

SHEET  
96  
OF  
623  
SHEETS

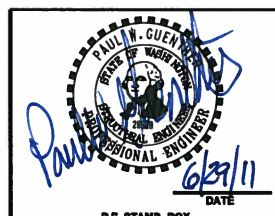




## RETAINING WALL RW2 DRAINAGE DROP STRUCTURE

**NOTES:**

1. SEE DRAINAGE PROFILES DP-0-04 AND DP-0-06 FOR CONNECTING PIPE DETAILS.
2. SEE RETAINING WALL PLANS FOR SOIL NAIL WALL DETAILS.
3. SEE ROADWAY PLANS FOR CONCRETE BARRIER AND PAVING DETAILS.

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**I-405 CORRIDOR**  
DESIGN-BUILDERS

An Integrated Transportation Solution



**I-405  
I-5 TO SR 169  
STAGE 2 - WIDENING  
AND SR 515 INTERCHANGE  
DRAINAGE DROP STRUCTURE  
RETAINING WALL RW2**

**DRD-0-11**

SHEET  
161  
OF  
623  
SHEETS

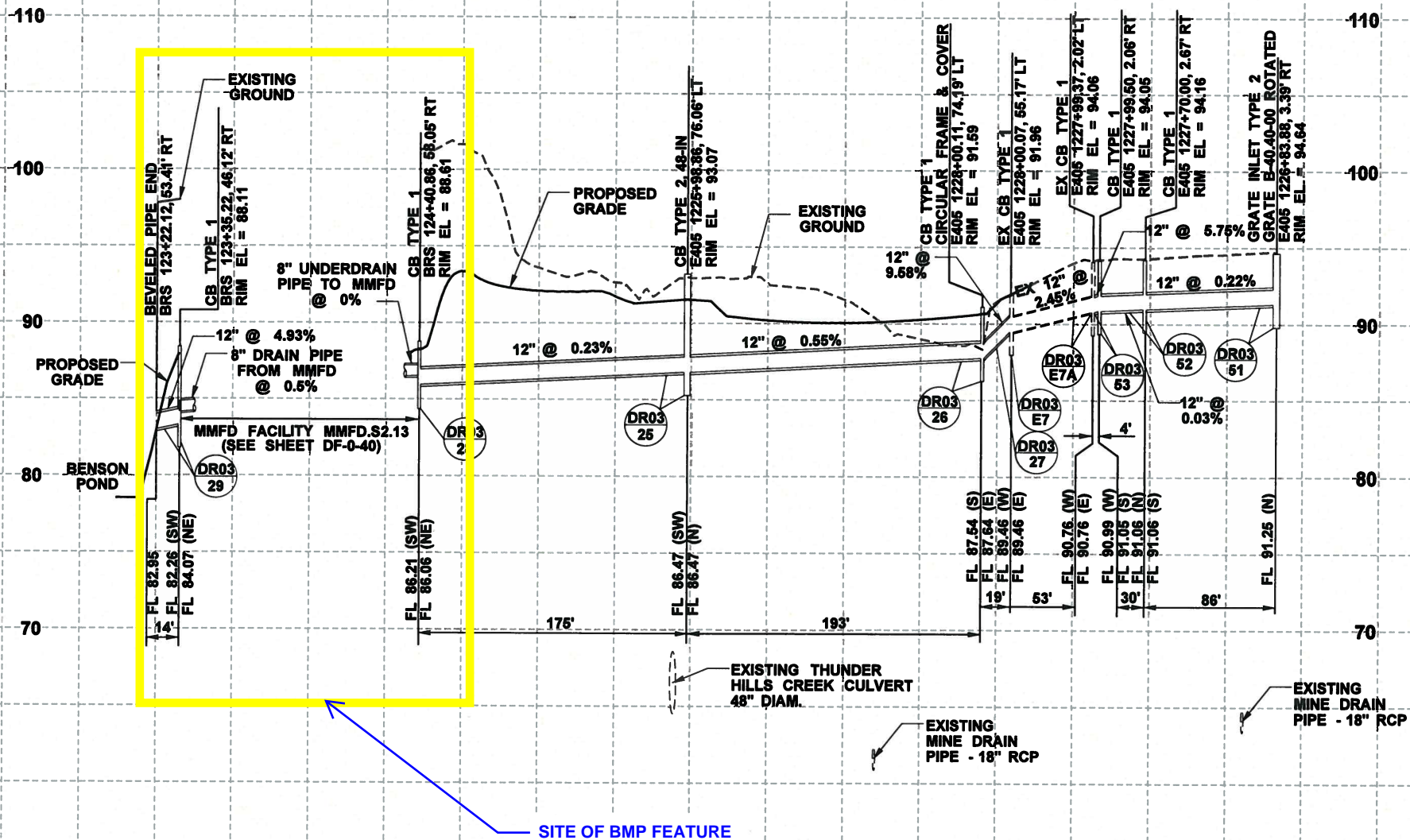
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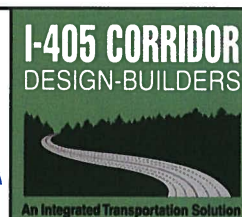
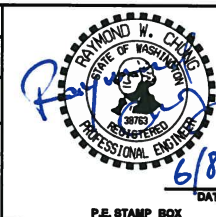


## NOTES:

1. ALL STORM SEWER PIPE WILL BE SCHEDULE A STORM SEWER PIPE PER SPECIFICATION 7-04 UNLESS OTHERWISE SHOWN ON DRAWINGS.
2. GRATE FOR CATCH BASINS WILL BE VANED GRATE UNLESS OTHERWISE SHOWN ON DRAWINGS.



NO.	ISSUE DATE	ISSUE RECORD - DESCRIPTION	DESIGNED BY	ENTERED BY	CHECKED BY	DESIGN MANAGER:	REGION NO.	STATE
						J. BAUMAN	10	WASH
2	08/07/11	REISSUED	R. CHUNG	K. LORENTSON	R. CHUNG	DESIGN TASK LEAD:	7624	CONTRACT NO.
1	04/02/10	RELEASED FOR CONSTRUCTION - 3D	S. CHRISTOPHERSON	S. TAYLOR	R. ADAMS	R. ADAMS		
C	02/10/10	FINAL DESIGN - 3D	S. CHRISTOPHERSON	S. TAYLOR	R. CHUNG	PACKAGE:		
0	12/09/09	RELEASED FOR CONSTRUCTION - 2B	S. CHRISTOPHERSON	S. TAYLOR	R. ADAMS			
B	11/11/09	FINAL DESIGN - 2B SUPPLEMENT	S. CHRISTOPHERSON	S. TAYLOR	T. MCCARTHY			
A	08/01/09	PRELIMINARY DESIGN	R. CHUNG	J. TYLER	G. CALEY			



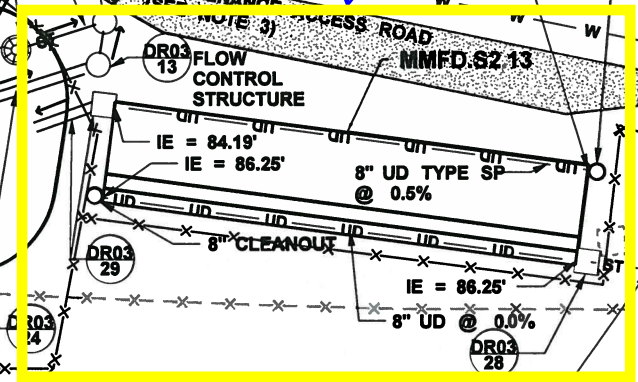
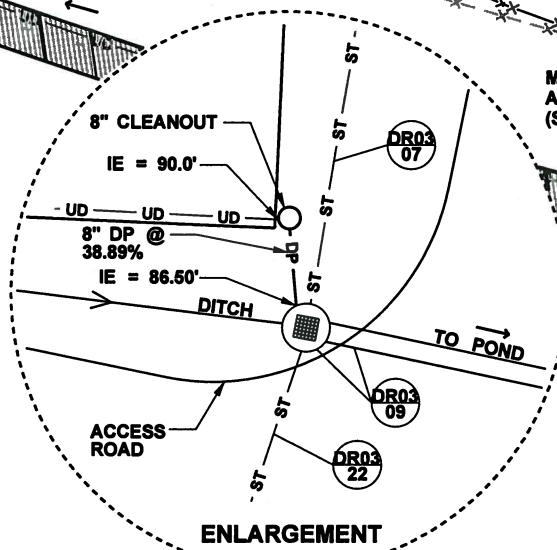
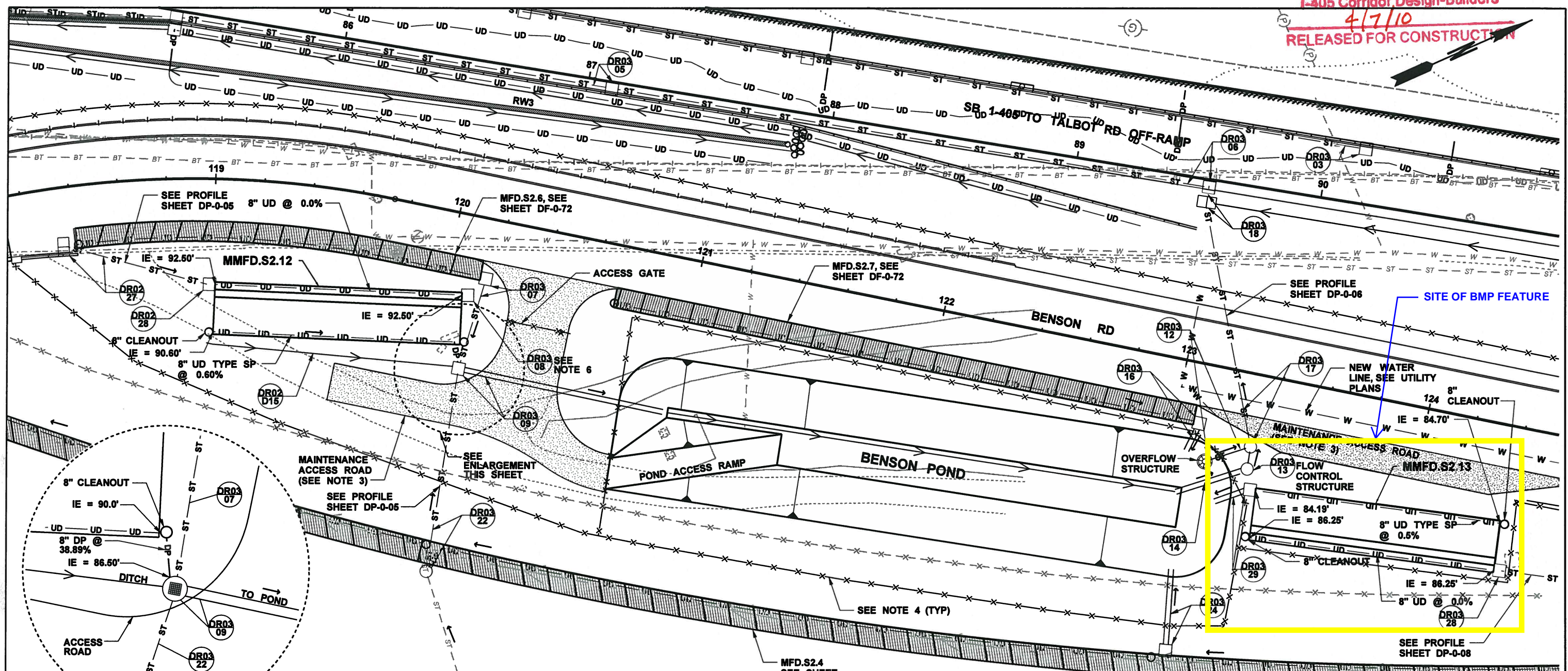
I-405  
I-5 TO SR 169  
STAGE 2 - WIDENING  
AND SR 515 INTERCHANGE  
DRAINAGE PROFILES

DP-0-08

SHEET  
116  
OF  
623  
SHEETS

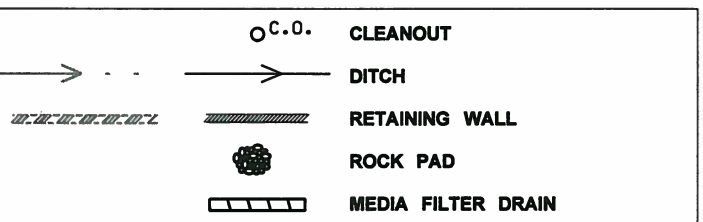


I-405 Corridor Design-Build 13  
4/7/10  
RELEASED FOR CONSTRUCTION



- NOTES:**
1. SEE SHEET DRD-0-08 AND DRD-0-12 FOR MODIFIED MEDIA FILTER DRAIN DETAILS.
  2. SEE SHEET DRD-0-05 AND DRD-0-06 FOR POND DETAILS.
  3. SEE SHEET DRD-0-06 FOR MAINTENANCE ACCESS ROAD DETAILS.
  4. SEE ROADWAY PLANS FOR FENCE DETAILS.
  5. SEE SHEETS DF-0-41, DF-0-42, AND DR-0-43 FOR GRADING.
  6. DR03-08/ CONCRETE INLET/ BRS 120+09.74, 31.94 RT/ RIM EL = 95.25/ FL 92.50 (S).

LEGEND	
EXISTING	PROPOSED
- ST - ST -	- ST - ST - STORM DRAIN
- DP - DP -	- DP - DP - DRAIN PIPE
- UD - UD -	- UD - UD - UNDERDRAIN PIPE
- - - - -	- - - - - CULVERT
□	□ CATCH BASIN TYPE 1 AND 2 WITH GRATE OR CONCRETE INLET
▣	▣ GRATE INLET TYPE 2
○	○ MANHOLE OR CATCH BASIN TYPE 2 WITH CIRCULAR FRAME AND COVER



NO.	ISSUE DATE	ISSUE RECORD - DESCRIPTION	DESIGNED BY	ENTERED BY	CHECKED BY	DESIGN MANAGER:	REGION NO.	STATE
						J. BAUMAN	10	WASH
						DESIGN TASK LEAD:		
						R. ADAMS		
						PACKAGE:		
						RFC - 3D		
0	04/02/10	RELEASED FOR CONSTRUCTION - 3D	S.CHRISTOPHERSON	S. TAYLOR	R. ADAMS			
B	02/10/10	FINAL DESIGN - 3D	S.CHRISTOPHERSON	S. TAYLOR	R. ADAMS			
A	06/01/09	Preliminary Design	S.CHRISTOPHERSON	V. AHRNKIEL	G. CALEY			

**I-405 CORRIDOR**  
DESIGN-BUILDERS

**I-405**  
I-5 TO SR 169  
STAGE 2 - WIDENING  
AND SR 515 INTERCHANGE  
BENSON POND & MMFD AREAS  
SITE PLAN

DF-0-40

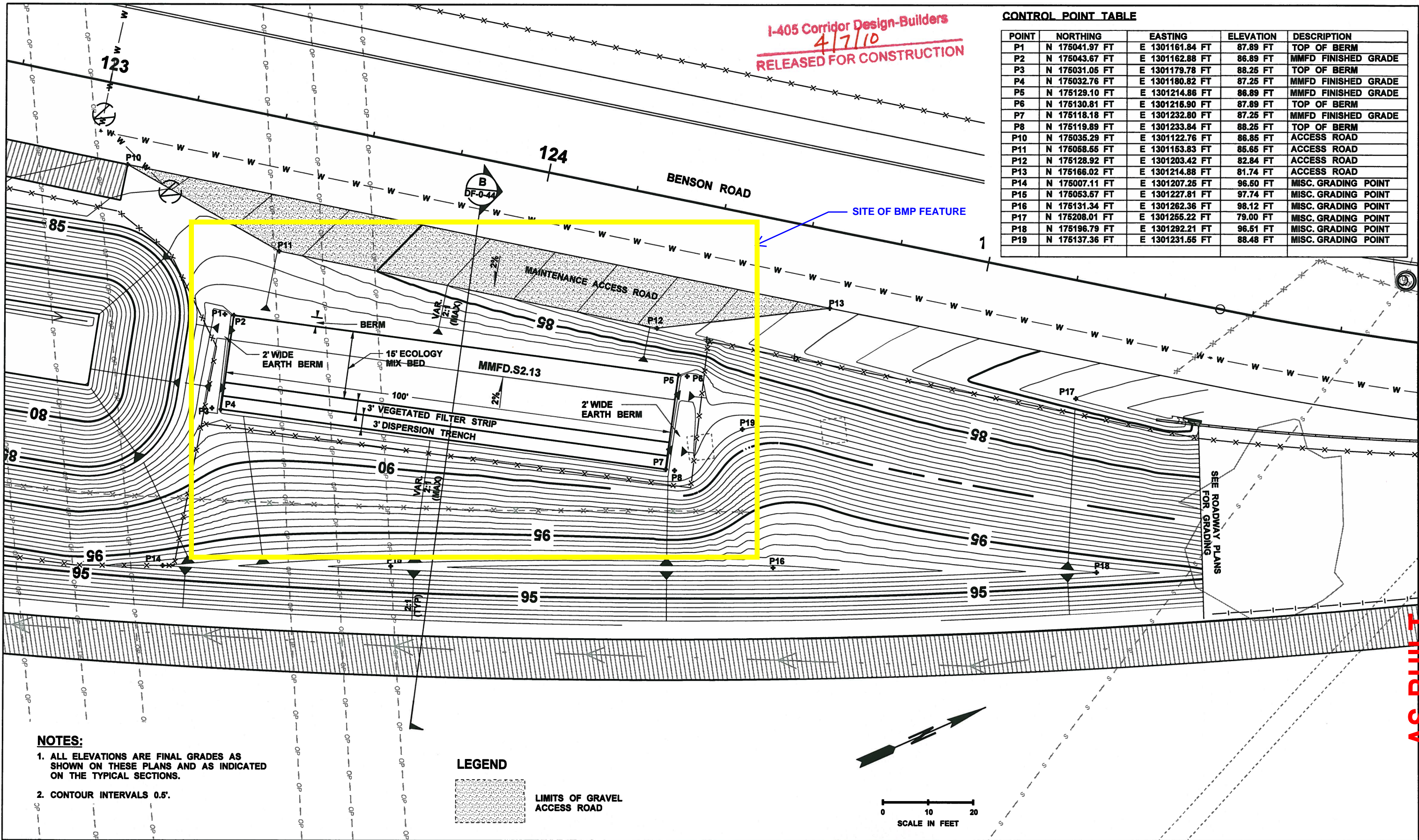
SHEET 135 OF 135

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CONTROL POINT TABLE

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
P1	N 175041.97 FT	E 1301161.84 FT	87.89 FT	TOP OF BERM
P2	N 175043.67 FT	E 1301162.88 FT	86.89 FT	MMFD FINISHED GRADE
P3	N 175031.05 FT	E 1301179.78 FT	88.25 FT	TOP OF BERM
P4	N 175032.76 FT	E 1301180.82 FT	87.25 FT	MMFD FINISHED GRADE
P5	N 175129.10 FT	E 1301214.86 FT	86.89 FT	MMFD FINISHED GRADE
P6	N 175130.81 FT	E 1301216.90 FT	87.89 FT	TOP OF BERM
P7	N 175118.18 FT	E 1301232.80 FT	87.25 FT	MMFD FINISHED GRADE
P8	N 175119.89 FT	E 1301233.84 FT	88.25 FT	TOP OF BERM
P10	N 175035.29 FT	E 1301122.76 FT	86.85 FT	ACCESS ROAD
P11	N 175058.55 FT	E 1301153.83 FT	85.65 FT	ACCESS ROAD
P12	N 175128.92 FT	E 1301203.42 FT	82.84 FT	ACCESS ROAD
P13	N 175166.02 FT	E 1301214.88 FT	81.74 FT	ACCESS ROAD
P14	N 175007.11 FT	E 1301207.25 FT	96.50 FT	MISC. GRADING POINT
P15	N 175053.57 FT	E 1301227.81 FT	97.74 FT	MISC. GRADING POINT
P16	N 175131.34 FT	E 1301262.36 FT	98.12 FT	MISC. GRADING POINT
P17	N 175208.01 FT	E 1301255.22 FT	79.00 FT	MISC. GRADING POINT
P18	N 175196.79 FT	E 1301292.21 FT	96.51 FT	MISC. GRADING POINT
P19	N 175137.36 FT	E 1301231.55 FT	88.48 FT	MISC. GRADING POINT

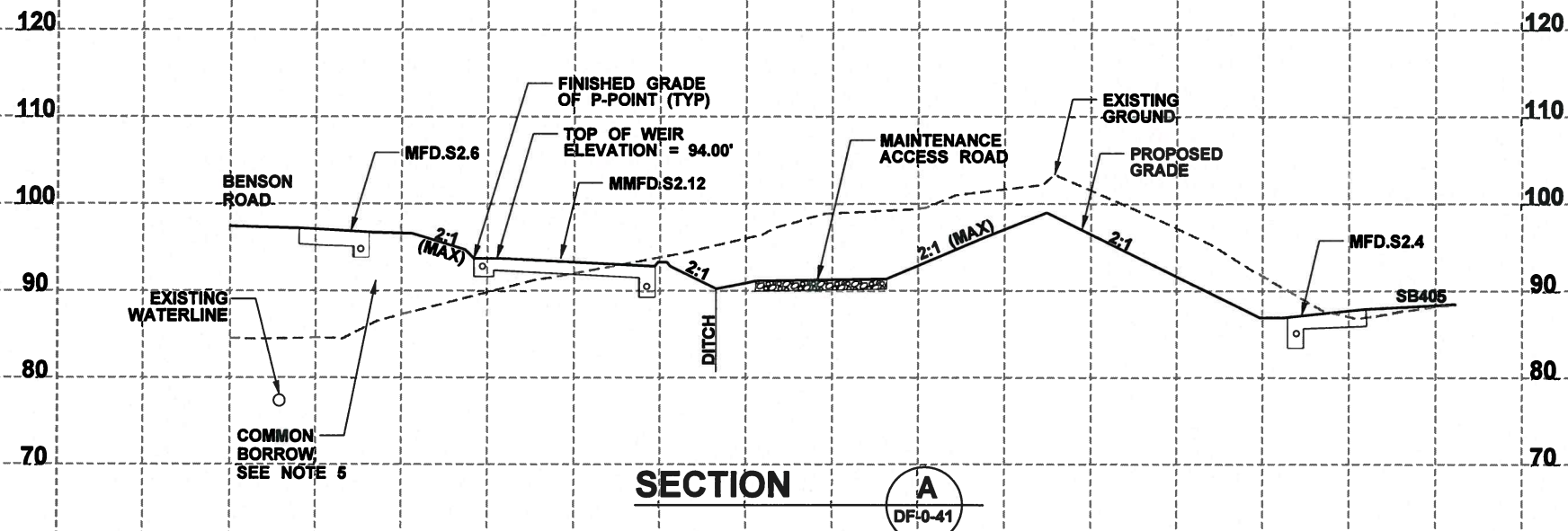
NO.	ISSUE DATE	ISSUE RECORD - DESCRIPTION	DESIGNED BY	ENTERED BY	CHECKED BY	DESIGN MANAGER:	REGION NO.	STATE	CONTRACT NO.	DATE	PROJECT NAME	SHEET NO.
						J. BAUMAN	10	WASH				
						R. ADAMS						
0	04/02/10	RELEASED FOR CONSTRUCTION - 3D	S.CHRISTOPHERSON	S. TAYLOR	R. ADAMS	PACKAGE:			7624	4-5-2010	I-405 CORRIDOR DESIGN-BUILDERS	138
A	02/10/10	FINAL DESIGN - 3D	S.CHRISTOPHERSON	S. TAYLOR	R. ADAMS	RFC - 3D					Washington State Department of Transportation	OF 223 SHEETS

AS-BUILT



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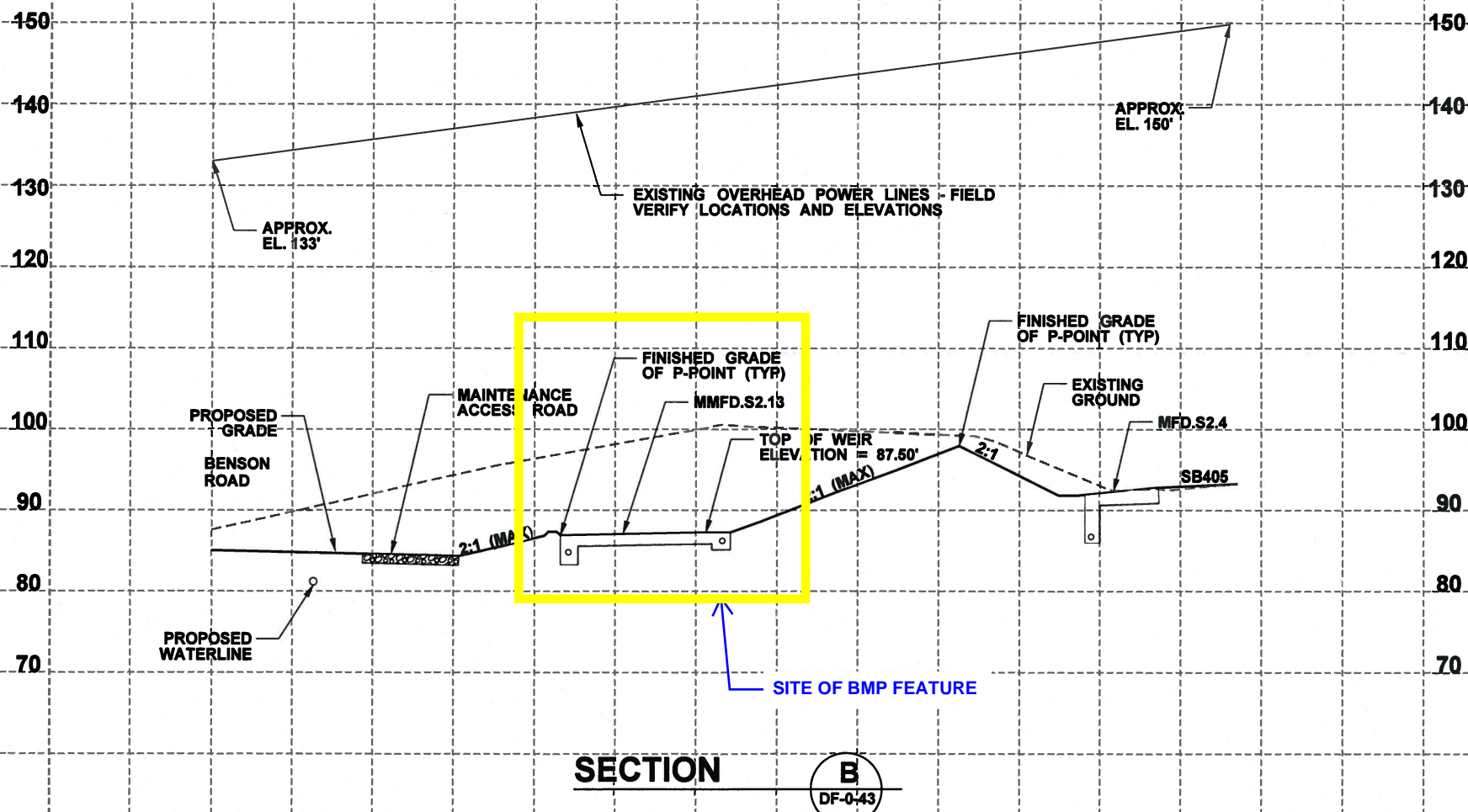
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I-405 Corridor Design-Builders  
4/7/10  
RELEASED FOR CONSTRUCTION

0 10 20  
HORIZONTAL SCALE IN FEET

0 10 20  
VERTICAL SCALE IN FEET

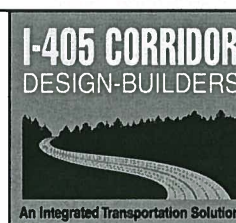


**NOTES:**

1. SEE SHEET DRD-0-07 FOR MFD DETAILS.
2. SEE SHEET DRD-0-08 AND DRD-0-12 FOR MMFD DETAILS.
3. SEE SHEET DRD-0-06 FOR MAINTENANCE ACCESS ROAD DETAILS.
4. SEE SHEET DRD-0-10 FOR DITCH DETAILS.
5. COMMON BORROW SHALL BE PER STANDARD SPECIFICATION 9-03.14(3). THE FILL MATERIAL SHALL BE COMPACTED ACCORDING TO SECTION 2-03.3(14)(C) (METHOD B) OF THE STANDARD SPECIFICATIONS, EXCEPT THAT ALL LAYERS SHALL BE COMPACTED TO 90% OF THE MAXIMUM DENSITY.

NO.	ISSUE DATE	ISSUE RECORD - DESCRIPTION	DESIGNED BY	ENTERED BY	CHECKED BY	DESIGN MANAGER:	REGION NO.	STATE
						J. BAUMAN	10	WASH
						DESIGN TASK LEAD:		
						R. ADAMS		
						PACKAGE:		
						RFC - 3D		
0	04/02/10	RELEASED FOR CONSTRUCTION - 3D	S.CHRISTOPHERSON	S. TAYLOR	R. ADAMS			
A	02/10/10	FINAL DESIGN - 3D	S.CHRISTOPHERSON	S. TAYLOR	R. ADAMS			

7624



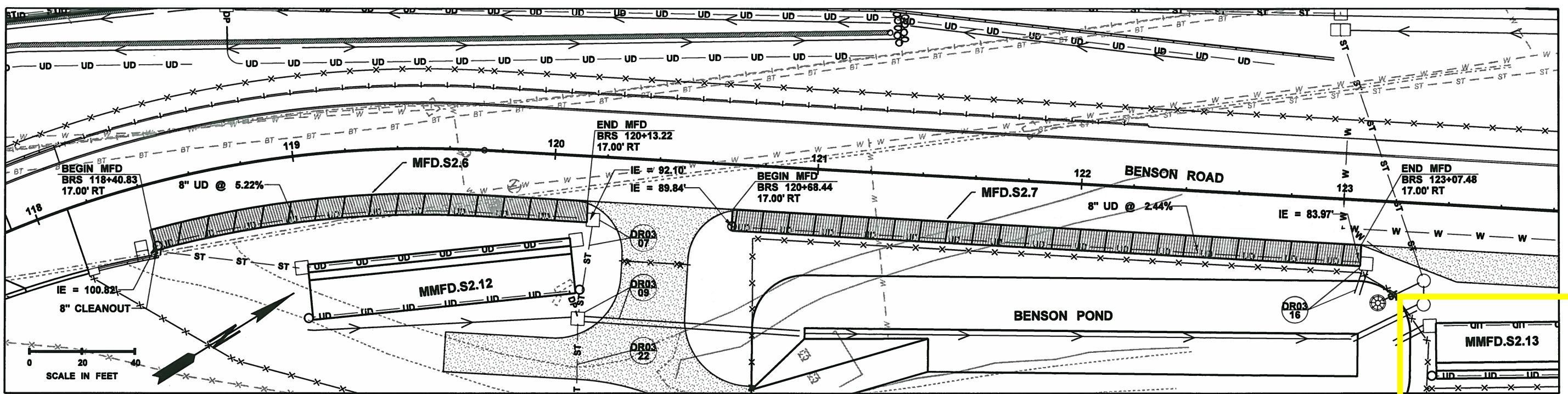
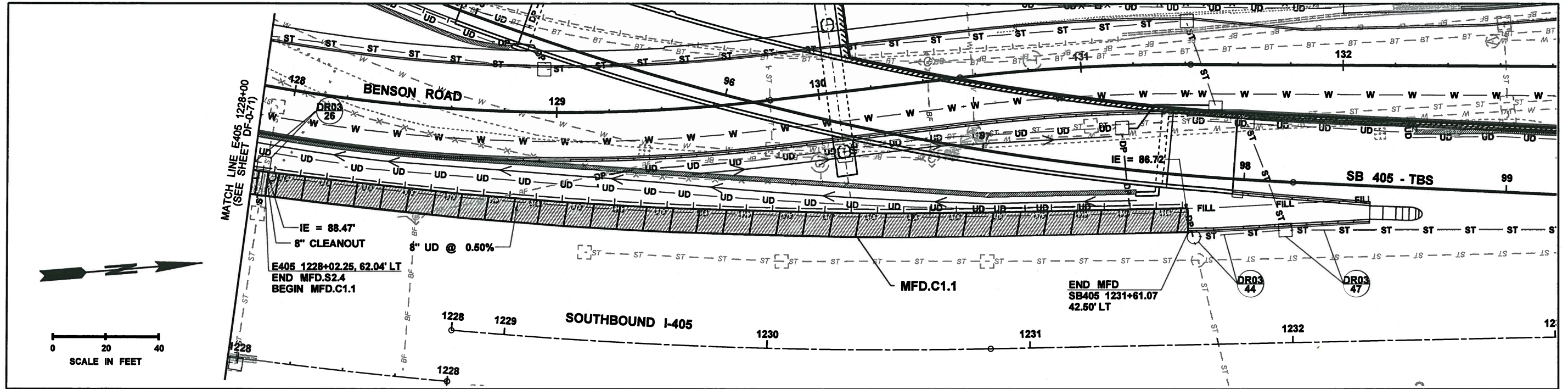
I-405  
I-5 TO SR 169  
STAGE 2 - WIDENING  
AND SR 515 INTERCHANGE  
BENSON POND & MMFD  
CROSS SECTIONS

DF-0-44

SHEET  
139  
OF  
623  
SHEETS

AS-BUILT





- NOTES:
1. SEE SHEET DRD-0-01 FOR DRAINAGE GENERAL NOTES.
  2. SEE SHEET DRD-0-07 FOR MEDIA FILTER DRAIN DETAILS.

SITE OF BMP FEATURE

NO.	ISSUE DATE	ISSUE RECORD - DESCRIPTION	DESIGNED BY	ENTERED BY	CHECKED BY	DESIGN MANAGER: J. BAUMAN	REGION NO.	STATE WASH	CONTRACT NO. 7624	DATE	Washington State Department of Transportation	I-405 I-5 TO SR 169 STAGE 2 - WIDENING AND SR 515 INTERCHANGE MEDIA FILTER DRAIN PLAN	DF-0-72
0	04/02/10	RELEASED FOR CONSTRUCTION - 3D	R. CHUNG	S. TAYLOR	R. ADAMS	PACKAGE: RFC - 3D							
A	02/10/10	FINAL DESIGN - 3D	R. CHUNG	S. TAYLOR	S. CHRISTOPHERSON								

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AS-BUILT





NTS

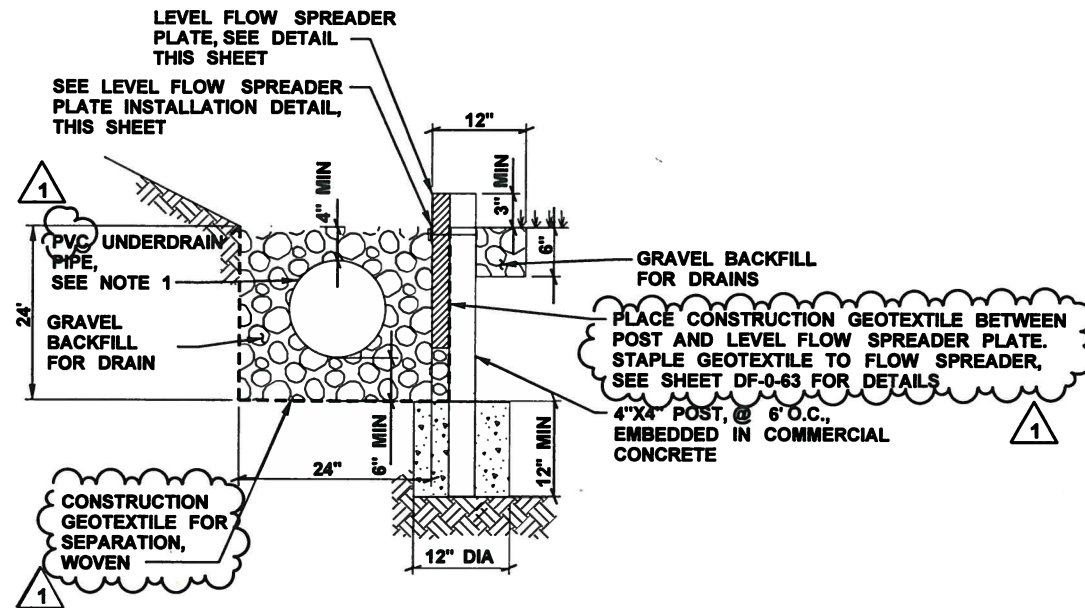


1. **MMFD.C1.2 REQUIRES SPECIAL DETAILS.  
SEE SHEET DF-0-63.**
2. **SEE DRD-0-12 FOR ADDITIONAL DETAILS  
AND CONSTRUCTION INSTALLATION NOTES.**
3. **MINIMIZE COMPACTION OF UNDERLYING SOILS BELOW  
THE VEGETED FILTER STRIP AND MEDIA FILTER MIX.**



# AS-BUILT



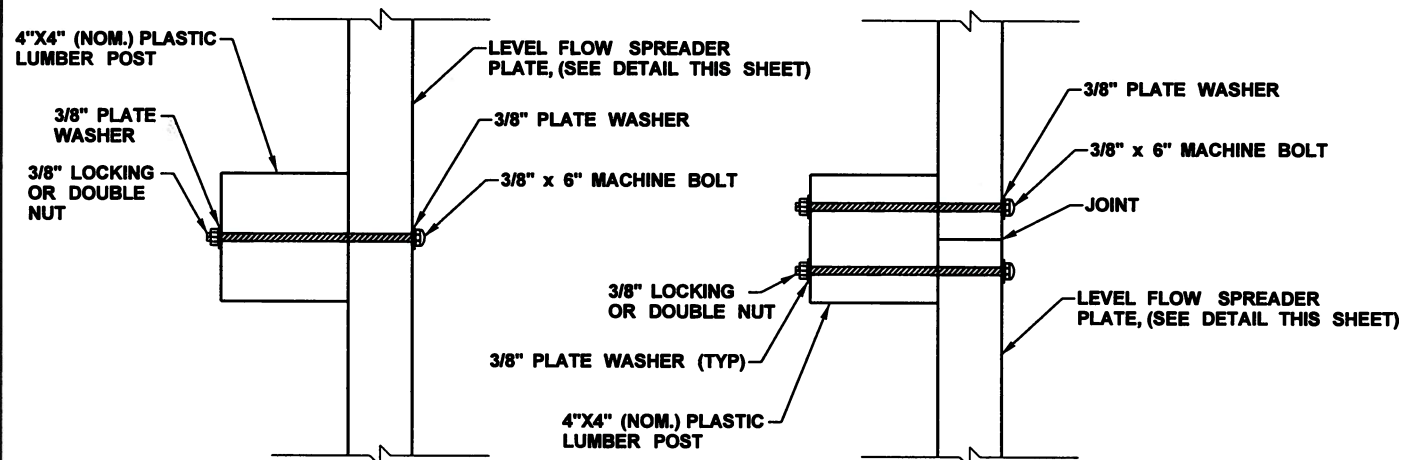


**DISPERSION TRENCH DETAIL**

NTS

**NOTES:**

1. SLOTTED UNDERDRAIN PIPE PERFORATIONS ON TOP OF PIPE SHALL BE LEVEL.
2. DISPERSION TRENCH INSTALLATION AND VERIFICATION PROCEDURE:
  - A. EXCAVATE THE DISPERSION TRENCH PER THE TYPICAL DETAIL.
  - B. PLACE GRAVEL BACKFILL FOR DRAIN UP TO THE BOTTOM OF THE UNDERDRAIN PIPE. LEAVE THE BOLT ASSEMBLY ACCESSIBLE FOR LEVEL ADJUSTMENTS.
  - C. INSTALL THE LEVEL FLOW SPREADER PER DETAILS THIS SHEET.
  - D. DESIGN-BUILDER SHALL DEMONSTRATE EVEN DISPERSION OF FLOW THROUGH THE LEVEL FLOW SPREADER PLATE WITH WATER. ADJUST LEVEL SPREADER PLATE ELEVATIONS AS NEEDED TO ACHIEVE AN EVEN FLOW DISPERSAL. TESTING SHALL BE INSPECTED BY THE ENGINEER AND WSDOT REPRESENTATIVE.
  - E. UPON VERIFICATION BY THE ENGINEER AND WSDOT THAT THE FLOWS ARE EVENLY DISPERSED ALONG THE ENTIRE LENGTH OF THE FLOW SPREADER PLATE, PLACE REMAINING GRAVEL BACKFILL INTO THE DISPERSION TRENCH TO THE ELEVATION PER PLAN.



**POST AT CENTER - PLAN**

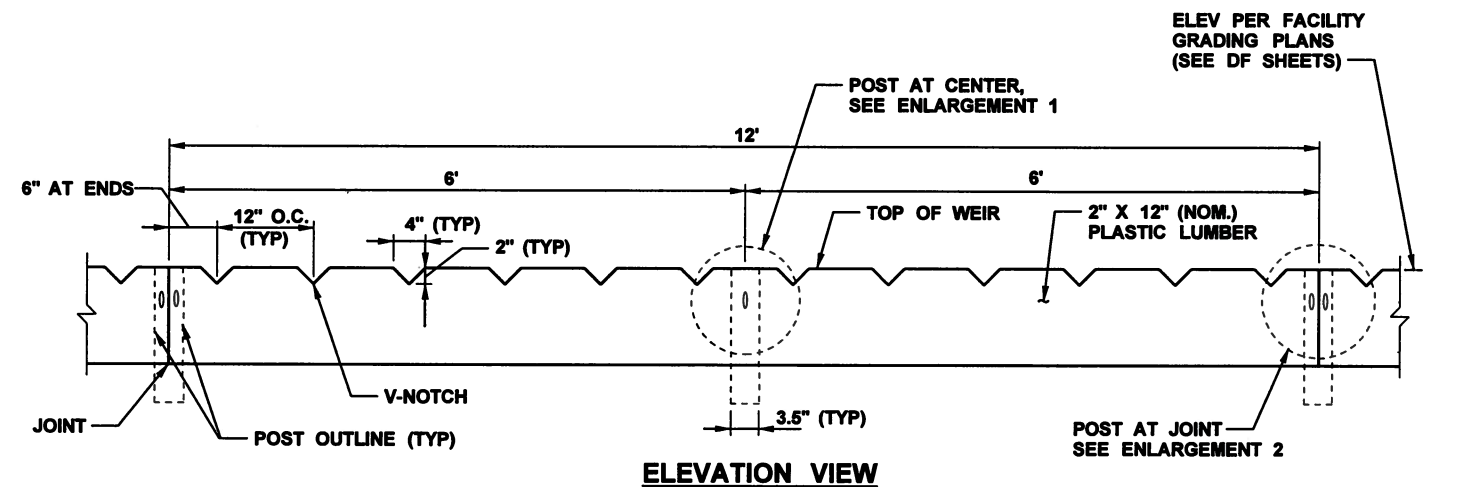
**POST AT JOINT - PLAN**

**LEVEL FLOW SPREADER PLATE  
INSTALLATION DETAIL**

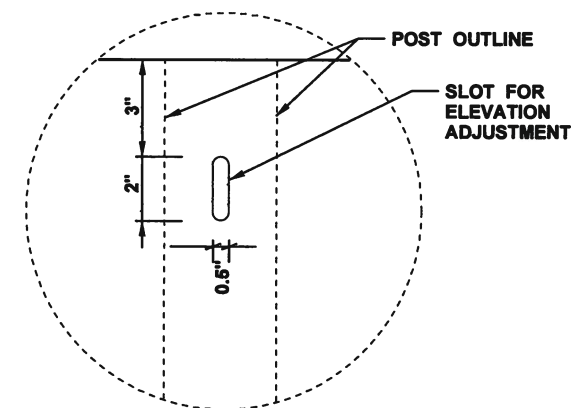
NTS

**NOTE:**

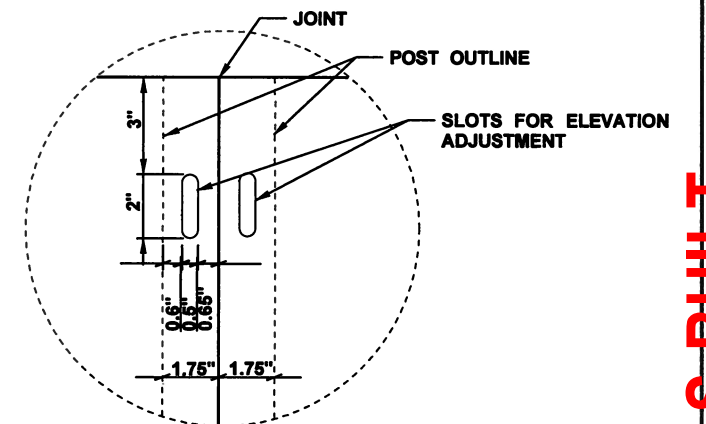
1. ALL METAL PARTS SHALL BE CORROSION RESISTANT AND NON-GALVINIZED, OR APPROVED EQUAL.
2. DO NOT PLACE V-NOTCHES IN FRONT OF POST.



**ELEVATION VIEW**



**ENLARGEMENT 1**



**ENLARGEMENT 2**

**LEVEL FLOW SPREADER PLATE**

NTS

NO.	ISSUE DATE	ISSUE RECORD - DESCRIPTION	DESIGNED BY	ENTERED BY	CHECKED BY	DESIGN MANAGER:	REGION NO.	STATE	CONTRACT NO.	DATE	PROJECT NAME	STAGE	DRD-0-12
						J. BAUMAN	10	WASH					
						R. ADAMS							
1	06/04/10	RFI #207 AND RFI #215	R. CHUNG	K. LORENTSON	R. ADAMS								
0	02/26/10	RELEASED FOR CONSTRUCTION - 3C	R. CHUNG	S. TAYLOR	R. ADAMS								
A	01/22/10	FINAL DESIGN - 3C	R. CHUNG	S. TAYLOR	R. ADAMS								

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7624

6-4-2010

P.E. STAMP BOX

I-405 CORRIDOR  
DESIGN-BUILDERS

Washington State  
Department of Transportation

I-405  
I-5 TO SR 169  
STAGE 2 - WIDENING  
AND SR 515 INTERCHANGE

MODIFIED MEDIA FILTER DRAIN DETAILS

SHEET  
162  
OF  
623  
SHEETS



## APPENDIX D: KEY WSDOT MAINTENANCE MANUAL EXCERPTS



### General

Managing water on the right of way requires a drainage system that effectively responds to the immediate environment. A typical highway drainage system includes conveyances of all types, gutters, drains, ditches, culverts, storm sewers, and other miscellaneous drainage structures.

The system is designed and constructed to collect, treat, and remove storm water from the highway right of way. It must be properly maintained to:

- Permit the maximum use of the roadway.
- Prevent damage to the highway structure.
- Protect natural resources.
- Protect abutting property from physical damage.
- Comply with applicable stormwater management permits.

Drainage facilities should be maintained as nearly as possible to the condition and at the capacity for which they were originally designed and constructed. The entire drainage system should be generally inspected at least twice a year or otherwise based on specific environmental permit requirements, past experience, and professional judgement. Deficiencies should be corrected after they are discovered. Additional inspections may be required during heavy storms and periods of high runoff in order to determine the effectiveness of the system. High water marks should be observed and recorded as well as conditions that threaten damage to the drainage facility or the highway. Maintenance personnel must be continually alert to assure that all natural water course channels crossing the right of way remain open.

### Drainage From Abutting Properties

Storm water is the only effluent allowed to be discharged upon the highway right of way. [Revised Code of Washington Chapter 47.44](#) allows persons and entities who have been issued utility franchises or permits to encroach on or cross highway right of way to install and maintain the item for which the permit was granted.

Population growth, urban sprawl, and numerous new regulations restrict how maintenance crews can maintain surface and subsurface drainage systems. Regulations that may affect drainage maintenance include:

- Endangered Species Act
- Federal Clean Water Act – National Pollutant Discharge Elimination System (NPDES)
- Storm Water Management
- Wetlands Preservation
- Growth Management
- Shorelines
- Irrigation Limitations



It is important that the Washington State Department of Transportation (WSDOT) not allow abutting property owners to discharge water onto the highway right of way without obtaining a permit. Property owners may obtain permits by applying at the WSDOT area or region office. Drainage design engineers and maintenance staff review potential drainage impacts from the abutting property to the highway right of way. The property owner may be required to mitigate water quality and/or quantity impacts to obtain a permit.

Maintenance personnel who routinely patrol a roadway section must be trained in the basic knowledge of what types of direct drainage and sheet flow from abutting property may require a permit. These include new:

- Commercial developments such as shopping centers.
- Subdivisions.
- Industrial development.
- Automobile wrecking yards.
- Dairy and other intensive farming activities.

Maintenance personnel should report land use changes they observe to their supervisor. The supervisor will forward this information to the appropriate reviewer.

## Ditches and Gutters

Open ditches should be routinely checked and maintained as close as possible to the line, grade, depth, and cross section to which they were constructed. Vegetation in ditches often helps prevent erosion and treats storm water. Remove vegetation only when flow is blocked or excess sediments have accumulated. Remove vegetation using “best management practices” that minimize erosion and sediment escape to water bodies.

Excessive erosion of drainage ditches must be controlled or repaired. Ditch linings of loose or grouted rock and concrete or other energy dissipation methods can control erosion. However, these linings need be checked frequently and repaired as necessary.

Keep ditches and gutters free of litter and debris. Repair cracks and breaks as necessary.

Be especially careful when chemicals are used for brush and grass control in open ditches. Herbicides must be carefully controlled so as not to contaminate water or to transfer and concentrate chemicals in adjacent areas where environmental damage may result. Always follow product application instructions.

Be alert for diversion ditches on top of cut slopes that prevent slope erosion by intercepting surface drainage. Diversion ditches must be maintained to retain their diversion shape and capability.

Surplus material that results from ditch cleaning can often be used for widening. Material placed into the adjacent portions of the highway or disposal areas must not obstruct or impair other roadside drainage areas. Do not use material that may cause sedimentation problems to water bodies. Take care to avoid causing erosion problems or loose unstable fills. Do not use non-porous materials such as clay. They can become unstable when wet and trap water in the existing fill. If there is doubt about using such surplus material, contact the Region Soils Engineer for assistance and consult with your Region Maintenance Environmental Coordinator.



Do not blade ditch cleanings across roadway surfaces. Dirt and debris remaining on the pavement after ditch cleaning operations must be swept from the pavement.

Avoid undercutting the roadway back slope or in slope. Undercutting weakens the slope and will cause damaging slip-outs and other forms of slope erosion.

## Rockfall Ditches and Slope Benches

Keep rock fall ditches and slope benches clean. Large amounts of slough or rock fall and other slide material that effectively block the ditch or bench should be removed as soon as possible.

## Dry Wells

Dry wells accommodate the drainage flow in certain areas where:

- Natural outfalls for a drainage system were not available.
- Their use reduces the need for or size of downstream facilities.

These dry wells should be inspected periodically. Replace the drain rock if storm water no longer percolates into the soil. Within NPDES permit coverage areas, dry wells must be inspected annually and maintained to the applicable standards found in the WSDOT *Highway Runoff Manual* M 31-16. Inspection frequencies may be revised in accordance with NPDES permit provisions. Inspection and maintenance work completed on dry wells within NPDES permit coverage areas must be documented in the Highway Activity Tracking System (HATS) to meet annual reporting requirements.

## Culverts

A culvert is a conduit or pipe used as an artificial channel under a roadway or embankment to maintain flow from a natural channel or drainage ditch. As a general guideline, culverts should be inspected twice a year, once before the fall/winter storms and once after the rainy season has ended to ensure they are clean and in good operating condition. Culverts may be inspected more or less than this frequency based on the past history of the particular culvert.

A detailed culvert inspection form is found in HATS and shall be used to document the observations made during a culvert condition inspection. This type of inspection is called a Level One inspection. If the Level One Inspection reveals potential problems with the culvert, the maintenance technician can indicate on the inspection form, the need for a Level Two inspection, which will be conducted by a hydraulic engineer.

Changes in the upstream watershed due to logging, land development activities, farming practices, forest fires, etc., may increase water runoff, sedimentation, and debris. With these conditions more frequent inspections, particularly after periods of high runoff, are necessary to enable maintenance personnel to take corrective measures if damage has occurred. During storms and floods, critical areas need to be inspected and the culvert inlets kept clear. For these inspections that are in response to storms and floods, Level One Inspection records do not need to be completed. However, a Multiple Work Activity record may be used in HATS to document this type of weather event-response, drainage inspection. Since this type of inspection is generally limited to a quick look to see whether or not a culvert is obstructed during a storm event, this does not constitute a full Level One inspection.



Badly worn or broken culverts should be repaired, replaced, or rehabilitated to minimize the possibility of damage to the roadbed by water saturating the fill material. Depending on the scope of this work, it may be completed by state workforces in the Maintenance Program or by contractors under the funding and management of the Preservation Program. All culvert repair work conducted within the Maintenance Program shall be documented in HATS.

Culverts with 50 percent or more constriction should be flushed or otherwise cleaned to restore the culvert's original capacity. (Use BMPs to minimize adverse impacts to water quality or fish when doing this work). Some of the larger culverts in flowing streams are designed for construction below the stream bed, to accommodate fish life. In these cases, the culvert should also be cleared of obstructions that may be detrimental to the passage of fish. All culvert cleaning work conducted shall be documented in HATS.

Culverts should be checked for scour around the inlet and outlet. Scoured areas should be repaired with rip-rap or some other protection if necessary. In some cases, standing water is desirable at the inlet end of the culvert to settle out sediment. Vegetation at culvert ends can be controlled by residual herbicides or mechanical means.

Controlled burning of vegetation at culvert ends is a feasible alternative at some locations. Whatever method of vegetation control utilized needs to be accompanied by erosion and sediment control features/practices.

Pavement markings that show the location of culverts should be renewed annually. These markings are critical for quickly locating culverts for both emergency and routine maintenance. Pavement markings of more permanent materials, such as thermoplastics, are encouraged.

## **Automatic Pumps**

Automatic pumps, sumps, and pipes at underpass structures or draining depressed sections of highway must be kept in good operating condition at all times. Each installation must be inspected on a routine basis, at least once per week. Inspections should include the electrical, ventilation, greasing and drainage systems.

## **Under Drains**

Under drains are often constructed in the sub-grade to intercept subsurface water from springs and seepage water from the surface or percolating from below. Control of this water is essential to ensure the stability of the sub-grade upon which the highway is constructed.

Inspect under drains on the same schedule as culverts. Keep their outlets open and clean. Choked under drains can be cleaned by high pressure flushing with water or flexible sewer rods. In cases where roots effectively block the drainage, the use of herbicides may be indicated. Whatever method of cleaning is used, consideration for erosion and sediment control is needed.



## Horizontal Drains

Horizontal drains (HDs) are effective devices in some locations for draining water from hillsides to help maintain slope stability. They are generally plastic pipes that have been engineered and constructed into hillsides. When drilling into the hillside during initial installation, a steel casing is used but once the plastic drainpipe is placed in the hillside, the steel casing is pulled out, leaving the final HD in place. The HD is typically 37 mm (1.5 inches) in diameter and can reach several hundred feet or more back into the hillside. Inspection and maintenance for HDs is recommended at an annual frequency, and is optimally completed with guidance from a person experienced with the installation or maintenance of such drains. Over time, HDs can become clogged by silt, minerals, and biological matter or sheared off due to ground movement. This would result in reduced flows and unfavorable increases in the groundwater level and, therefore, would increase the risk of renewed slide activity. The following guidance should be used for the inspection and cleaning of horizontal drains. Documenting the maintenance operation and results achieved at the time of cleaning will provide accurate and usable records for engineering evaluation and long-term asset management.

### **Horizontal Drain Outlet**

The HD should protrude from the finished slope. The discharge end of the HD pipe is open to allow water to flow out. However, in the event a collection piping system or manifold is installed, a cap is attached to the end of the HD pipe to access the pipe for cleanout. The collection pipes should be attached in a manner that does not conflict with future maintenance operations. Ideally, the HD should be photographed and its location, length of each pipe, and other details of the HD should be documented in an as-built as part of the construction documentation. This information should be provided by the Construction Office to the Area Maintenance Office who will be maintaining the HDs. The Chief Engineering Geologist in the Geotechnical Office may be helpful in acquiring an as-built for the HD. If a detailed as-built is not completed during construction, the location of the HD outlet should be documented with GPS coordinates when it is initially maintained. A sketch map may be helpful for ongoing inspection and maintenance activities. Access and maintenance needs should be communicated to HD designers in the Geotechnical Office and/or in the Region Design Office during the design process so these issues can be given full consideration during project development.

### **Location Marking**

Since the HD outlets can become obscured over time with vegetation or other hillside debris, their location should be marked in the field so they can be easily found for routine inspection and maintenance. A short, green stripe should be painted perpendicular to the travel lane at the edge of pavement to mark the location of the HD outlet. If the painted mark becomes worn over time, it should be re-painted as part of the routine HD inspection. A short piece of surveyor's tape or ribbon can also be tied around the HD outlet to make it more visible on the hillside. A carsonite marker may also be placed at the HD outlet for this purpose.



## ***Inspection and Cleaning***

Inspection should preferably be done by a person familiar with the design, installation, or maintenance of HDs. Flows from each HD should be measured prior to cleaning. This can be done by timing the volume discharged into a five gallon bucket and reported as gallons per minute (gpm). A numbering system or some type of identification scheme for the drains should be established and recorded in HATS so inspection and cleaning operation can be documented against each specific drain. The cleaning procedure should be done only after initial flows are measured and recorded for all HDs. Adjacent drain flows can be affected during the flushing operation. Inspections and cleaning of HDs should be documented in HATS. The feature type in HATS that should be selected for this is “pipe ends.” During the inspection, any field marking that has worn away or is missing should be noted for refreshing or replacement. Items such as any blockage or damage to the HD outlet, if the HD outlet is becoming obscured from view should be documented. The amount of water draining from the HD should also be identified in the HATS record. Once the cleaning is complete and a sufficient amount of time has lapsed to ensure that all cleaning or surging waters have drained from the HD, flows should be measured again and recorded. Some removal of vegetation may be required to allow for completion of an HD inspection.

## ***Cleaning Equipment***

Vector trucks or trailer-mounted vector units are commonly used to provide an adequate water supply and pressure for HD cleaning. Vector units may need to be modified for HD cleaning. These units usually come with hoses on a hydraulically-controlled feed spool system. This hose may need to be replaced with smaller diameter hose to clean the smaller diameter HD pipe that is typically 37-mm (1.5-in) diameter. The hose will need to be several hundred feet in length and be equipped with proper swivel connections to allow for maximum rotation. Pressure washer pumps can also be configured and used for HD cleaning if vector units are not available.

## ***Nozzle and Hose***

Nozzles have been developed for pipeline cleaning which are self-feeding. Nozzles are designed with four main components: (1) size of hose attachment, (2) gallons per minute (gpm) delivered, (3) maximum pressure rating (psi), and (4) physical design (shape) of the nozzle. Hoses are limited to certain gpm and psi ratings. A high strength, very lightweight, thermal plastic hose is usually used.

A hose for cleaning long horizontal drain pipes should allow for at least 12 gpm of flow. Head loss is greater in a smaller diameter hose, therefore making it much less effective at advancing into the pipe at greater depths. The hose should be rated for at least 5,000 psi working pressure. Nozzle designs vary greatly. Markings may be made on the hose at 25-foot intervals to assist in the HD cleaning procedure described below. Such markings would have to be refreshed periodically as they become worn from repeated HD cleanings. Having two or three nozzle types to adapt to actual field conditions is recommended. At least two nozzles should be available for use that have one central front jet and six rear radial jets which are angled back at about 15 degrees. The radial jets help to feed the hose into the drain pipe, as well as provide flushing of the drain slots in the horizontal drain pipe. The nozzle outside diameter should not



be more than 27 mm (1.1 in). The design of the nozzle should be matched to the hose to gain maximum pull by the self-advancing nozzle. The selection of nozzles should be done by a nozzle supplier who can match the pump and delivery system with the hose selected for optimal design. The length of the nozzle is not critical, but a compact overall design is recommended.

### **Cleaning Sequence**

Pressure should be limited to 2,000 psi at the nozzle. The flow should be maximized to speed up the cleaning process. A minimum of 12 gpm should be used. Cal-Trans prepared a report “Effectiveness of Horizontal Drains” (Report No. FHWA/CA/TL-80/16) which states that “best performance can be expected when pressures are maintained between 1,600 and 2,000 psi and when the water volume is 30 gpm or more.” The general sequence for cleaning drains is very simple unless obstructions are encountered. After any protective caps have been removed, advance the nozzle with enough pressure to maintain a slow, steady feed rate. Drains should be cleaned in a slow, steady manner so that permanent damage to the drains may be avoided. The hose should never be advanced at a very fast speed directly to the end of the drain. The nozzle and hose should be inserted about 8 m (25 ft) and then removed at a slow, steady rate of about 0.3 to 1.0 m/sec (1 to 3 ft/sec). After the first 8 m (25 ft) and slow removal, the nozzle should be advanced to 15 m (50 ft) and then removed at the recommended rate. This process should be continued by adding about 8 m (25 ft) each time and noting the amount of debris and sediment each time. Once the full depth of the drain has been reached, the pressure should be turned up to 1,800 to 2,000 psi and the hose slowly removed at a rate of 0.3 to 0.7 m/sec (1 to 2 ft/sec). This higher pressure cleaning is the major cleaning of the drain. If obstructions are encountered, the depth of the obstruction should be measured and recorded.

The rear jets that advance the hose act as cleaning jets when removed in a slow, steady manner.

During the entire operation of cleaning, the nozzle should not be allowed to sit at one location at high pressure as this may damage the drain pipe and scour material from outside the drain pipe. At no time should air pressure be used in the drain pipe. Also, the drain outlet must always be open during flushing to prevent the buildup of pipe pressure which could ultimately damage the HD. If a significant amount of material is removed, it is recommended to repeat this higher pressure cleaning. It is not necessary to do this more than twice. It is important that the operator knows the drain depth and makes sure to stop the nozzle 4 to 7 m (15 to 25 ft) short of the end of the drain, so that the end cap of the drain pipe may not be damaged. If the use of such high pressures results in HD damage, test with lower pressures (possibly 600 psi) to determine the highest allowable pressure which consistently does not cause damage.

### **Surging**

Surging is the process of flooding or filling the HD with water, then letting it drain out in an effort to stimulate water flow in the HD. During the cleaning process, the pressurized water being sprayed through nozzles inside the drain can push through slots in the HD and compress soil particles in an outward direction from the HD. If this appears to have decreased the flow of water from the HD, a surging procedure can be used to help re-establish flow in the horizontal drains. Surging operations are



performed after the jet-cleaning operation. The pump should provide about 50-gpm and 1,500 psi pressure during the surging operation. The hose diameter could be 20 to 25 mm (0.75 to 1 in). The operation is performed in several 60 second cycles. Any protective caps should be replaced after all cleaning and surging operations are completed.

## Storm Sewers and Catch Basins

In many areas underground pipe systems are necessary to carry storm runoff normally handled by ditches. Storm sewers are often used in long, depressed highways or along curbed sections on city streets. Water carried by the system is generally collected through inlets, catch basins, or manholes and carried by pipe to an out fall on a natural waterway.

Clogged pipes can often be cleaned with high-pressure water jets. But, if tree roots or broken pipes are causing the clogging, more service will be required. Flexible rotary cutters will remove roots intruding into a pipe.

Broken pipes may be repaired by jacking an insert liner into the failed location. Otherwise, the failed pipe may have to be excavated and relayed to repair it. Whatever method of cleaning is selected, consideration for erosion and sediment control is needed. In no case can debris or sediment be allowed to enter a water body.

Manholes are generally used where there is a change in profile or alignment and also at strategic points in long, straight sections in order to provide access for cleaning the conduit.

Periodically inspect and clean inlets, catch basins, and manholes using a vacuum truck or manual cleaning methods. Conduct inspections during storms to ensure that the inlet grates are not becoming clogged with water-born debris. Schedule sweeping operations to help prevent the accumulation of leaves, paper, or other clogging debris.

Within NPDES permit coverage areas, catch basins must be inspected annually and maintained to the applicable standards found in the WSDOT [Highway Runoff Manual](#) M 31-16. Inspection frequencies may be revised in accordance with NPDES permit provisions. Inspection and maintenance work completed on catch basins within NPDES permit coverage areas must be documented in HATS or the Maintenance Real Time Data Collection and Mapping System to meet annual reporting requirements.

When pavement is overlaid by contract or maintenance work crews be sure that the manhole covers are flush with the finished pavement elevations.



## Bank Protection

Maintenance personnel must be continually alert to conditions that may cause scour, undermining, or washout of highway embankments or structures by storms, floods, or wave action.

Highways adjacent to water courses, drainage ways, and embankments throughout the state are protected in a variety of ways against damage due to high water. These include barbs, stone rip-rap, grouted rip-rap, pile revetments, retaining walls and cribs, rock and wire mesh (gabions), and vegetation.

These features must be inspected during storms or periods of high water, as well as at least once each spring or after major high water periods, and repairs made where required. Make repairs with materials similar to those in place. If possible take corrective measures to eliminate the direct cause of the damage.

Hydraulic Project Approval permits (Washington State Department of Fish and Wildlife) and other regulatory permits may apply to this type of work. Permits are commonly conditioned to protect fish life and habitat.

When the need for significant additional bank protection around structures or embankments is indicated, the area superintendent is to be notified immediately and a determination made as to whether or not the protection materials will be placed by maintenance or construction forces. New bank protection projects should be reviewed by hydraulic engineers to ensure that proper design and risk/safety factors are addressed.

## Detention Ponds, Tanks, and other Stormwater Treatment Facilities

Designers are increasingly specifying the use of detention ponds and tanks that store water runoff and release it slowly through a controlled out fall or outlet. In this way the size of downstream pipes and culverts can be reduced, erosion is mitigated, and solids that settle out can be removed. Other stormwater treatment facilities, commonly referred to as Best Management Practices, or BMPs, are also increasingly being used to comply with stormwater management requirements.

To function correctly the controlled out fall or outlet pipe must be free of debris. Accumulated settled materials must be removed on a schedule based on experience at each site. If oil separators are combined with these facilities, timely removal and proper disposal of oils is essential.

Within NPDES permit coverage areas, detention ponds, tanks, and other types of BMPs must be inspected annually and maintained to the applicable standards found in the WSDOT *Highway Runoff Manual* M 31-16. Inspection frequencies may be revised in accordance with NPDES permit provisions. Inspection and maintenance work completed on detention ponds, tanks, and other BMPs within NPDES permit coverage areas must be documented in the Highway Activity Tracking System (HATS) to meet annual reporting requirements.

If inspection or cleaning necessitates working inside an underground detention tank, confined space procedures must be followed.



## APPENDIX E: KEY HIGHWAY RUNOFF MANUAL EXCERPTS



Table 5-12 Maintenance standards for detention ponds.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and debris	Accumulations exceed 5 cubic feet (about equal to the amount of trash needed to fill one standard-size garbage can) per 1,000 square feet. In general, there should be no visual evidence of dumping.  If less than threshold, all trash and debris will be removed as part of the next scheduled maintenance.	Trash and debris are cleared from site.
	Poisonous vegetation and noxious weeds	Poisonous or nuisance vegetation may constitute a hazard to maintenance personnel or the public.  Noxious weeds as defined by state or local regulations are evident.  (Apply requirements of adopted integrated pest management [IPM] policies for the use of herbicides).	No danger is posed by poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department.)  Complete eradication of noxious weeds may not be possible. Compliance with state or local eradication policies is required.
	Contaminants and pollution	Oil, gasoline, contaminants, or other pollutants are evident.  (Coordinate removal/cleanup with local water quality response agency.)	No contaminants or pollutants are present.
	Rodent holes	For facilities acting as a dam or berm: rodent holes are evident or there is evidence of water piping through dam or berm via rodent holes.	Rodents are destroyed and dam or berm repaired.  (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
	Beaver dams	Dam results in change or function of the facility.	Facility is returned to design function.  (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies.)
	Insects	Insects such as wasps and hornets interfere with maintenance activities.	Insects are destroyed or removed from site.  Insecticides are applied in compliance with adopted IPM policies.
	Tree growth and hazard trees	Tree growth does not allow maintenance access or interferes with maintenance activity (slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove.  Dead, diseased, or dying trees are observed. (Use a certified arborist to determine health of tree or removal requirements.)	Trees do not hinder maintenance activities. Harvested trees can be processed or converted to mulch and either kept on site where it can be used as needed around the BMP, or taken off site.  Hazard trees are removed.
Side slopes of pond	Erosion	Eroded damage is over 2 inches deep and cause of damage is still present, or there is potential for continued erosion.  Erosion is observed on a compacted berm embankment.	Slopes are stabilized using appropriate erosion control measures (such as rock reinforcement, planting of grass, and compaction).  If erosion is occurring on compacted berms, a licensed civil engineer should be consulted to resolve source of erosion.

Table 5-12 Maintenance standards for detention ponds (continued).



Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage area	Sediment	Accumulated sediment exceeds 10% of the designed pond depth, unless otherwise specified, or affects inletting or outletting condition of the facility.	Sediment is cleaned out to designed pond shape and depth. Pond is reseeded if necessary to control erosion.
	Liner (if applicable)	Liner is visible and has more than three ¼-inch holes in it.	Liner is repaired or replaced. Liner is fully covered.
Pond berms (dikes)	Settlements	Any part of berm has settled 4 inches lower than the design elevation. (If settlement is apparent, measure berm to determine amount of settlement.)  Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Water flow is discernible through pond berm. Ongoing erosion is observed, with potential for erosion to continue.  (Recommend a geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.)	Piping is eliminated. Erosion potential is resolved.
Emergency overflow/spillway and berms over 4 feet high	Tree growth	Tree growth on emergency spillways reduces spillway conveyance capacity and may cause erosion elsewhere on the pond perimeter due to uncontrolled overtopping.  Tree growth on berms over 4 feet high may lead to piping through the berm, which could lead to failure of the berm and related erosion or flood damage.	Trees should be removed. If root system is small (base less than 4 inches), the root system may be left in place; otherwise, the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
	Piping	Water flow is discernible through pond berm. Ongoing erosion is observed, with potential for erosion to continue.  (Recommend a geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.)	Piping is eliminated. Erosion potential is resolved.
Emergency overflow/spillway	Spillway lining insufficient	Only one layer of rock exists above native soil in area 5 square feet or larger, or native soil is exposed at the top of outflow path of spillway.  (Riprap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.



**Table 5-13 Maintenance standards for bioinfiltration ponds/infiltration trenches/basins.**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
<b>General</b>	Trash and debris	See <a href="#">Table 5-24</a> (wet ponds).	See <a href="#">Table 5-24</a> (wet ponds).
	Poisonous/noxious vegetation	See <a href="#">Table 5-24</a> (wet ponds).	See <a href="#">Table 5-24</a> (wet ponds).
	Contaminants and pollution	See <a href="#">Table 5-24</a> (wet ponds).	See <a href="#">Table 5-24</a> (wet ponds).
	Rodent holes	See <a href="#">Table 5-24</a> (wet ponds).	See <a href="#">Table 5-24</a> (wet ponds).
<b>Storage area</b>	Sediment	Water ponds in infiltration pond after rainfall ceases and appropriate time has been allowed for infiltration.  (A percolation test pit or test of facility indicates facility is working at only 90% of its designed capabilities. If 2 inches or more of sediment present, remove sediment).	Sediment is removed or facility is cleaned so that infiltration system works according to design.
<b>Rock filters</b>	Sediment and debris	By visual inspection, little or no water flows through filter during heavy rainstorms.	Gravel in rock filter is replaced.
<b>Side slopes of pond</b>	Erosion	See <a href="#">Table 5-24</a> (wet ponds).	See <a href="#">Table 5-24</a> (wet ponds).
<b>Emergency overflow/spillway and berms over 4 feet high</b>	Tree growth	See <a href="#">Table 5-24</a> (wet ponds).	See <a href="#">Table 5-24</a> (wet ponds).
	Piping	See <a href="#">Table 5-24</a> (wet ponds).	See <a href="#">Table 5-24</a> (wet ponds).
<b>Emergency overflow/spillway</b>	Rock missing	See <a href="#">Table 5-24</a> (wet ponds).	See <a href="#">Table 5-24</a> (wet ponds).
	Erosion	See <a href="#">Table 5-24</a> (wet ponds).	See <a href="#">Table 5-24</a> (wet ponds).
<b>Presettling ponds and vaults</b>	Facility or sump filled with sediment or debris	Sediment/debris exceeds 6 inches or designed sediment trap depth.	Sediment is removed.



Table 5-14 Maintenance standards for closed treatment systems (tanks/vaults).

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage area	Plugged air vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents are open and functioning.
	Debris and sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for $\frac{1}{2}$ length of storage vault or any point depth exceeds 15% of diameter.  (Example: 72-inch storage tank requires cleaning when sediment reaches depth of 7 inches for more than $\frac{1}{2}$ the length of the tank.)	All sediment and debris are removed from storage area.
	Joints between tank/pipe section	Openings or voids allow material to be transported into facility.  (Will require engineering analysis to determine structural stability.)	All joints between tank/pipe sections are sealed.
	Tank/pipe bent out of shape	Any part of tank/pipe is bent out of shape for more than 10% of its design shape.  (Review required by engineer to determine structural stability.)	Tank/pipe is repaired or replaced to design specifications.
	Vault structure: includes cracks in walls or bottom, damage to frame or top slab	Cracks are wider than $\frac{1}{2}$ inch and there is evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault is replaced or repaired to design specifications and is structurally sound.
		Cracks are wider than $\frac{1}{2}$ inch at the joint of any inlet/outlet pipe, or there is evidence of soil particles entering the vault through the walls.	No cracks are more than $\frac{1}{4}$ -inch wide at the joint of the inlet/outlet pipe.
Manhole	Cover not in place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than $\frac{1}{2}$ inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover difficult to remove	One maintenance person cannot remove lid after applying normal lifting pressure.  <i>Intent: To prevent cover from sealing off access to maintenance.</i>	Cover can be removed and reinstalled by one maintenance person.
	Ladder unsafe	Ladder is unsafe due to missing rungs, misalignment, unsecure attachment to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch basins	See <a href="#">Table 5-16</a> (catch basins).	See <a href="#">Table 5-16</a> (catch basins).	See <a href="#">Table 5-16</a> (catch basins).



**Table 5-15 Maintenance standards for control structure/flow restrictor.**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
<b>General</b>	Trash and debris (includes sediment)	Accumulation exceeds 25% of sump depth or is within 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris are removed.
	Structural damage	Structure is not securely attached to manhole wall.	Structure is securely attached to wall and outlet pipe.
		Structure is not in upright position; allow up to 10% from plumb.	Structure is in correct position.
		Connections to outlet pipe are not watertight and show signs of rust.	Connections to outlet pipe are watertight; structure is repaired or replaced and works as designed.
		Holes other than designed holes are observed in the structure.	Structure has no holes other than designed holes.
<b>Cleanout gate</b>	Damaged or missing	Cleanout gate is not watertight or is missing.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
		Gate is rusted over 50% of its surface area.	Gate is repaired or replaced to meet design standards.
<b>Orifice plate</b>	Damaged or missing	Control device is not working properly due to missing, out-of-place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Trash, debris, sediment, or vegetation blocks the plate.	Plate is free of all obstructions and works as designed.
<b>Overflow pipe</b>	Obstructions	Trash or debris blocks (or has the potential to block) the overflow pipe.	Pipe is free of all obstructions and works as designed.
<b>Manhole</b>	See <a href="#">Table 5-14</a> (closed treatment systems).	See <a href="#">Table 5-14</a> (closed treatment systems).	See <a href="#">Table 5-14</a> (closed treatment systems).
<b>Catch basin</b>	See <a href="#">Table 5-16</a> (catch basins).	See <a href="#">Table 5-16</a> (catch basins).	See <a href="#">Table 5-16</a> (catch basins).



Table 5-16 Maintenance standards for catch basins.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and debris	Trash or debris is immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No trash or debris is immediately in front of catch basin or on grate opening.
		Trash or debris (in the basin) exceeds 60% of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case is clearance less than 6 inches from the debris surface to the invert of the lowest pipe.	No trash or debris is in the catch basin.
		Trash or debris in any inlet or outlet pipe blocks more than $\frac{1}{3}$ of its height.	Inlet and outlet pipes are free of trash or debris.
		Dead animals or vegetation could generate odors that might cause complaints or dangerous gases (such as methane).	No vegetation or dead animals are present within the catch basin.
	Sediment	Sediment (in the basin) exceeds 60% of the sump depth as measured from the bottom of the basin to invert of the lowest pipe into or out of the basin, but in no case is clearance less than 6 inches from the sediment surface to the invert of the lowest pipe.	No sediment is in the catch basin.
	Structure damage to frame and/or top slab	Top slab has holes larger than 2 square inches or cracks wider than $\frac{1}{4}$ inch. <i>Intent: To make sure no material is running into basin.</i>	Top slab is free of holes and cracks.
		Frame is not sitting flush on top slab (separation of more than $\frac{3}{4}$ inch of the frame from the top slab). Frame is not securely attached.	Frame is sitting flush on the riser rings or top slab and is firmly attached.
	Fractures or cracks in basin walls/bottom	Maintenance person judges that structure is unsound.	Basin is replaced or repaired to design standards.
		Grout fillet has separated or cracked wider than $\frac{1}{2}$ inch and longer than 1 foot at the joint of any inlet/outlet pipe, or there is evidence that soil particles have entered catch basin through cracks.	Pipe is regouted and secure at the basin wall.
	Settlement/misalignment	Failure of basin has created a safety, function, or design problem.	Basin is replaced or repaired to design standards.
	Vegetation	Vegetation is growing across and blocking more than 10% of the basin opening.	No vegetation blocks the opening to the basin.
		Vegetation growing in inlet/outlet pipe joints is more than 6 inches tall and less than 6 inches apart.	No vegetation or root growth is present.
	Contamination and pollution	Oil, gasoline, contaminants, or other pollutants are evident. (Coordinate removal/cleanup with local water quality response agency.)	No pollution is present.
Catch basin cover	Cover not in place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than $\frac{1}{2}$ inch of thread.	Mechanism opens with proper tools.
Catch basin cover (continued)	Cover difficult to remove	One maintenance person cannot remove lid after applying normal lifting pressure. <i>Intent: To prevent cover from sealing off access to maintenance.</i>	Cover can be removed by one maintenance person.



**Table 5-16 Maintenance standards for catch basins (continued).**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Ladder	Ladder unsafe	Ladder is unsafe due to missing rungs, insecure attachment to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance staff safe access.
Metal grates (if applicable)	Grate opening unsafe	Grate opening is wider than $\frac{7}{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris block more than 20% of grate surface inletting capacity.	Grate is free of trash and debris.
	Damaged or missing	Grate is missing or components of the grate are broken.	Grate is in place and meets design standards.

**Table 5-17 Maintenance standards for debris barriers (such as trash racks).**

Maintenance Components	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and debris	Trash or debris plugs more than 20% of the openings in the barrier.	Barrier is cleared to design flow capacity.
Metal	Damaged/missing bars	Bars are bent out of shape more than 3 inches.	Bars are in place with no bends more than $\frac{3}{4}$ inch.
		Bars are missing or entire barrier is missing.	Bars are in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier is replaced or repaired to design standards.
	Inlet/outlet pipe	Debris barrier is missing or not attached to pipe.	Barrier is firmly attached to pipe.



Table 5-18 Maintenance standards for energy dissipaters.

Maintenance Components	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
<b>External:</b>			
<b>Rock pad</b>	Missing or moved rock	Only one layer of rock exists above native soil in area 5 square feet or larger, or native soil is exposed.	Rock pad is replaced to design standards.
	Erosion	Soil erosion is evident in or adjacent to rock pad.	Rock pad is replaced to design standards.
<b>Dispersion trench</b>	Pipe plugged with sediment	Accumulated sediment exceeds 20% of the design depth.	Pipe is cleaned/flushed so that it matches design.
	Not discharging water properly	There is visual evidence of water discharging at concentrated points along trench—normal condition is a “sheet flow” of water along trench. <i>Intent: To prevent erosion damage.</i>	Trench is redesigned or rebuilt to standards.
	Perforations plugged	Over ½ of perforations in pipe are plugged with debris and sediment.	Perforated pipe is cleaned or replaced.
	Water flows out top of “distributor” catch basin	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm, or water is causing (or appears likely to cause) damage.	Facility is rebuilt or redesigned to standards.
	Receiving area over-saturated	Water in receiving area is causing (or has potential of causing) landslide problems.	There is no danger of landslides.
<b>Internal:</b>			
<b>Manhole/chamber</b>	Worn or damaged post, baffles, side of chamber	Structure dissipating flow deteriorates to ½ of original size or any concentrated worn spot exceeds 1 square foot, which would make structure unsound.	Structure is replaced to design standards.
	Other defects	See entire contents of <a href="#">Table 5-16</a> (catch basins).	See entire contents of <a href="#">Table 5-16</a> (catch basins).



Table 5-19 Maintenance standards for biofiltration swale.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment accumulation on grass	Sediment depth exceeds 2 inches.	Remove sediment deposits on grass treatment area of the swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
	Standing water	Water stands in the swale between storms and does not drain freely.	Any of the following may apply: remove sediment or trash blockages; improve grade from head to foot of swale; remove clogged check dams; add underdrains; or convert to a wet biofiltration swale.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed through entire swale width.	Level the spreader and clean so that flows are spread evenly over entire swale width.
	Constant base flow	Small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	Add a low-flow pea gravel drain the length of the swale, or bypass the base flow around the swale.
	Poor vegetation coverage	Grass is sparse or bare, or eroded patches occur in more than 10% of the swale bottom.	Consult with roadside vegetation specialists to determine why grass growth is poor and correct the offending condition. Reseed into loosened, fertile soil or replant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 6 inches. Mowing is not required for wet biofiltration swales. However, fall harvesting of very dense vegetation after plant die-back is recommended.
	Excessive shading	Grass growth is poor because sunlight does not reach swale.	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.
	Inlet/outlet	Inlet/outlet areas are clogged with sediment/debris.	Remove material so there is no clogging or blockage in the inlet and outlet area.
	Trash and debris	Trash and debris have accumulated in the swale.	Remove trash and debris from bioswale.
	Erosion/scouring	Swale bottom has eroded or scoured due to flow channelization or high flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with 50/50 mixture of crushed gravel and compost. If bare areas are large (generally greater than 12 inches wide), the swale should be regraded and reseeded.  For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.



**Table 5-20 Maintenance standards for vegetated filter strip.**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment accumulation on grass	Sediment depth exceeds 2 inches.	Remove sediment deposits. Relevel so slope is even and flows pass evenly through strip.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow grass and control nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 6 inches.
	Trash and debris	Trash and debris have accumulated on the vegetated filter strip.	Remove trash and debris from filter.
	Erosion/scouring	Areas have eroded or scoured due to flow channelization or high flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with a 50/50 mixture of crushed gravel and compost. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the vegetated filter strip should be regraded and reseeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width.

**Table 5-21 Maintenance standards for media filter drain.**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment accumulation on grass filter strip	Sediment depth exceeds 2 inches or creates uneven grading that interferes with sheet flow.	Remove sediment deposits on grass treatment area of the embankment. When finished, embankment should be level from side to side and drain freely toward the toe of the embankment slope. There should be no areas of standing water once inflow has ceased.
	No-vegetation zone/flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire embankment width.	Level the spreader and clean so that flows are spread evenly over entire embankment width.
	Poor vegetation coverage	Grass is sparse or bare, or eroded patches are observed in more than 10% of the grass strip surface area.	Consult with roadside vegetation specialists to determine why grass growth is poor and correct the offending condition. Reseed into loosened, fertile soil or compost or replant with plugs of grass from the upper slope.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 6 inches.
	Media filter drain mix replacement	Water is seen on the surface of the media filter drain mix from storms that are less than a 6-month, 24-hour precipitation event. Maintenance also needed on a 10-year cycle and during a preservation project.	Excavate and replace all of the media filter drain mix contained within the media filter drain.
	Excessive shading	Grass growth is poor because sunlight does not reach embankment.	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.
	Trash and debris	Trash and debris have accumulated on embankment.	Remove trash and debris from embankment.
	Flooding of media filter drain	When media filter drain is inundated by flood water	Evaluate media filter drain material for acceptable infiltration rate and replace if media filter drain does not meet long-term infiltration rate standards.



Table 5-22 Maintenance standards for permeable pavement.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment accumulation	Collection of sediment is too coarse to pass through pavement.	Remove sediment deposits with high-pressure vacuum sweeper.
	Accumulation of leaves, needles, and other foliage	Accumulation on top of pavement is observed.	Remove with a leaf blower or high-pressure vacuum sweeper.
	Trash and debris	Trash and debris have accumulated on the pavement.	Remove by hand or with a high-pressure vacuum sweeper.
	Oil accumulation	Oil collection is observed on top of pavement.	Immediately remove with a vacuum and follow up by a pressure wash or other appropriate rinse procedure.
Visual facility identification	Not aware of permeable pavement location	Facility markers are missing or not readable.	Replace facility identification where needed.
Annual minimum maintenance			Remove potential void-clogging debris with a biannual or annual high-pressure vacuum sweeping.

Table 5-23 Maintenance standards for dispersion areas (natural and engineered).

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment accumulation on dispersion area	Sediment depth exceeds 2 inches.	Remove sediment deposits while minimizing compaction of soils in dispersion area. Relevel so slope is even and flows pass evenly over/through dispersion area. Handwork is recommended rather than use of heavy machinery.
	Vegetation	Vegetation is sparse or dying; significant areas are without ground cover.	Control nuisance vegetation. Add vegetation, preferably native ground cover, bushes, and trees (where consistent with safety standards) to bare areas or areas where the initial plantings have died.
	Trash and debris	Trash and debris have accumulated on the dispersion area.	Remove trash and debris from filter. Handwork is recommended rather than use of heavy machinery.
	Erosion/scouring	Eroded or scoured areas due to flow channelization, or high flows are observed.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel/compost mix (see <a href="#">Section 5-4.3.2</a> for the compost specifications). The grass will creep in over the rock mix in time. If bare areas are large (generally greater than 12 inches wide), the dispersion area should be reseeded. For smaller bare areas, overseed when bare spots are evident. Look for opportunities to locate flow spreaders, such as dispersion trenches and rock pads.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width.



Table 5-24 Maintenance standards for wet ponds.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Water level	First cell is empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
	Trash and debris	Accumulations exceed 1 cubic foot per 1,000 square feet of pond area.	Remove trash and debris from pond.
	Inlet/outlet pipe	Inlet/outlet pipe is clogged with sediment or debris material.	Unclog and unblock inlet and outlet piping.
	Sediment accumulation in pond bottom	Sediment accumulations in pond bottom exceed the depth of sediment zone plus 6 inches, usually in the first cell.	Remove sediment from pond bottom.
	Oil sheen on water	Oil sheen is prevalent and visible.	Remove oil from water using oil-absorbent pads or Vactor truck. Locate and correct source of oil. If chronic low levels of oil persist, plant wetland species such as <i>Juncus effusus</i> (soft rush), which can uptake small concentrations of oil.
	Erosion	Pond side slopes or bottom show evidence of erosion or scouring in excess of 6 inches and the potential for continued erosion is evident.	Stabilize slopes using proper erosion control measures and repair methods.
	Settlement of pond dike/berm	Any part of the pond dike/berm has settled 4 inches or lower than the design elevation, or the inspector determines dike/berm is unsound.	Repair dike/berm to specifications.
	Internal berm	Berm dividing cells are not level.	Level berm surface so that water flows evenly over entire length of berm.
	Overflow/spillway	Rock is missing and soil exposed at top of spillway or outside slope.	Replace rocks to specifications.



## APPENDIX F: KEY AVIATION STORMWATER DESIGN MANUAL EXCERPTS



**Table 6-2. Maintenance standards for Infiltration BMPs: AR.03 (Bioinfiltration Pond); AR.04 (Infiltration Pond); AR.05 (Infiltration Trench); AR.09 (Detention Pond); AR.06 (Infiltration Vault); AR.07 (Dry Well).**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and debris	Accumulations exceed 1 cubic feet per 1,000 square feet (this is about equal to the amount of trash needed to fill one standard-size garbage can). In general, there should be no visual evidence of dumping.  If less than threshold, all trash and debris will be removed as part of the next scheduled maintenance.	Trash and debris are cleared from site.
	Poisonous vegetation and noxious weeds	Poisonous or nuisance vegetation may constitute a hazard to maintenance personnel or the public.  Noxious weeds as defined by state or local regulations are evident.  (Apply requirements of adopted integrated pest management [IPM] policies for the use of herbicides).	No danger is posed by poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department.)  Complete eradication of noxious weeds may not be possible. Compliance with state or local eradication policies is required.
	Contaminants and pollution	Oil, gasoline, contaminants, or other pollutants are evident. (Coordinate removal/cleanup with local water quality response agency.)	No contaminants or pollutants are present.
	Rodent holes	For facilities acting as a dam or berm: rodent holes are evident or there is evidence of water piping through dam or berm via rodent holes.	Rodents are destroyed and dam or berm repaired.  (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
	Beaver dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies.)
	Insects	Insects such as wasps and hornets interfere with maintenance activities.	Insects are destroyed or removed from site.  Apply insecticides in compliance with adopted IPM policies.
	Tree growth and hazard trees	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove.  Dead, diseased, or dying trees are observed. (Use a certified arborist to determine health of tree or removal requirements.)	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).  Remove hazard trees.
	Water level	First cell is empty, does not hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
	Inlet/outlet pipe	Inlet/outlet pipe is clogged with sediment or debris material.	The inlet and outlet piping are not clogged or blocked.



**Table 6-2 (continued). Maintenance standards for Infiltration BMPs: AR.03 (Bioinfiltration Pond); AR.04 (Infiltration Pond); AR.05 (Infiltration Trench); AR.09 (Detention Pond); AR.06 (Infiltration Vault); AR.07 (Dry Well).**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General (continued)	Sediment depth in first cell	Sediment depth exceeds 6 inches.	Sediment is removed from pond bottom.
	Oil sheen on water	Oil sheen is prevalent and visible.	Oil is removed from water using oil-absorbent pads or Vactor truck. Source of oil is located and corrected. If chronic low levels of oil persist, plant wetland species such as <i>Juncus effusus</i> (soft rush), which can uptake small concentrations of oil.
	Erosion	Pond side slopes or bottom show evidence of erosion or scouring in excess of 6 inches and the potential for continued erosion is evident.	Slopes are stabilized using proper erosion control measures and repair methods.
	Settlement of pond dike/berm	Any part of the pond dike/berm has settled 4 inches or lower than the design elevation, or the inspector determines dike/berm is unsound.	Dike/berm is repaired to specifications.
	Internal berm	Berm dividing cells are not level.	Berm surface is leveled so that water flows evenly over entire length of berm.
	Overflow/spillway	Rock is missing and soil exposed at top of spillway or outside slope.	Rocks are replaced to specifications.
Side slopes of pond	Erosion	Eroded damage is over 2 inches deep and cause of damage is still present or there is potential for continued erosion.  Erosion is observed on a compacted berm embankment.	Slopes are stabilized using appropriate erosion control measures; e.g., rock reinforcement, planting of grass, compaction.  If erosion is occurring on compacted berms, a licensed civil engineer should be consulted to resolve source of erosion.
Storage area	Sediment	Accumulated sediment exceeds 10% of the designed pond depth, unless otherwise specified, or affects inletting or outletting condition of the facility.	Sediment is cleaned out to designed pond shape and depth; pond is reseeded if necessary to control erosion.
		Water ponds in infiltration pond after rainfall ceases and appropriate time has been allowed for infiltration. (A percolation test pit or test of facility indicates facility is working at only 90% of its designed capabilities. If 2 inches or more sediment is present, remove sediment).	Sediment is removed or facility is cleaned so that infiltration system works according to design.
		Sediment accumulation is such that that it permits undesirable numbers, height, or species of plant growth.	Undesireable plants and sediment are removed.
	Liner (if applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner is repaired or replaced. Liner is fully covered.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.



**Table 6-2 (continued). Maintenance standards for Infiltration BMPs: AR.03 (Bioinfiltration Pond); AR.04 (Infiltration Pond); AR.05 (Infiltration Trench); AR.09 (Detention Pond); AR.06 (Infiltration Vault); AR.07 (Dry Well).**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Rock filters	Sediment and debris	By visual inspection, little or no water flows through filter during heavy rainstorms.	Gravel in rock filter is replaced.
Pond berms (dikes)	Settlements	Any part of berm has settled 4 inches lower than the design elevation.  If settlement is apparent, measure berm to determine amount of settlement.  Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Water flow is discernible through pond berm. Ongoing erosion is observed, with potential for erosion to continue. (Recommend a geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.)	Piping is eliminated. Erosion potential is resolved.
Emergency overflow/spillway and berms over 4 feet high	Tree growth	Tree growth on emergency spillways reduces spillway conveyance capacity and may cause erosion elsewhere on the pond perimeter due to uncontrolled overtopping.  Tree growth on berms over 4 feet high may lead to piping through the berm, which could lead to failure of the berm and related erosion or flood damage.	Trees should be removed. If root system is small (base less than 4 inches), the root system may be left in place; otherwise, the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
	Piping	Water flow is discernible through pond berm. Ongoing erosion is observed, with potential for erosion to continue. (Recommend a geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.)	Piping is eliminated. Erosion potential is resolved.
Emergency overflow/spillway	Spillway lining insufficient	Only one layer of rock exists above native soil in area 5 square feet or larger, or native soil is exposed at the top of outflow path of spillway. (Riprap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
Presetting ponds and vaults	Facility or sump filled with sediment or debris	Sediment/debris exceeds 6 inches or designed sediment trap depth.	Sediment is removed.



**Table 6-5. Maintenance standards for BMP AR.13 (Biofiltration Swale).**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment accumulation on grass	Sediment depth exceeds 2 inches.	Remove sediment deposits on grass treatment area of the swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
	Standing water	Water stands in the swale between storms and does not drain freely.	Any of the following may apply: remove sediment or trash blockages; improve grade from head to foot of swale; remove clogged check dams; add underdrains; or convert to a wet biofiltration swale.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed through entire swale width.	Level the spreader and clean so that flows are spread evenly over entire swale width.
	Constant baseflow	Small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	Add a low-flow pea gravel drain the length of the swale, or bypass the baseflow around the swale.
	Poor vegetation coverage	Grass is sparse or bare, or eroded patches occur in more than 10% of the swale bottom.	Determine why grass growth is poor and correct that condition. Replant with plugs of grass from the upper slope; plant in the swale bottom at 8-inch intervals; or reseed into loosened, fertile soil.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.  Mowing is not required for wet biofiltration swales. However, fall harvesting of very dense vegetation after plant die-back is recommended.
	Excessive shading	Grass growth is poor because sunlight does not reach swale.	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.
	Inlet/outlet	Inlet/outlet areas are clogged with sediment and/or debris.	Remove material so there is no clogging or blockage in the inlet and outlet area.
	Trash and debris	Trash and debris have accumulated in the swale.	Remove trash and debris from bioswale.
	Erosion/scouring	Swale bottom has eroded or scoured due to flow channelization or high flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large (generally greater than 12 inches wide), the swale should be regraded and reseeded. For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.



**Table 6-6. Maintenance standards for BMP AR.14 (Media Filter Drain).**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment accumulation on grass filter strip	Sediment depth exceeds 2 inches or creates uneven grading that interferes with sheet flow.	Remove sediment deposits on grass treatment area of the embankment. When finished, embankment should be level from side to side and drain freely toward the toe of the embankment slope. There should be no areas of standing water once inflow has ceased.
	No-vegetation zone/flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire embankment width.	Level the spreader and clean so that flows are spread evenly over entire embankment width.
	Poor vegetation coverage	Grass is sparse or bare, or eroded patches are observed in more than 10% of the vegetated filter strip surface area.	Consult with roadside vegetation specialists to determine why grass growth is poor and correct the offending condition. Replant with plugs of grass from the upper slope or reseed into loosened, fertile soil or compost.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.
	MFD mix replacement	Water is seen on the surface of the MFD mix from storms that are less than a 6-month, 24-hour precipitation event. Maintenance also needed on a 10-year cycle and during a preservation project.	Excavate and replace all of the MFD mix contained within the media filter drain.
	Excessive shading	Grass growth is poor because sunlight does not reach embankment.	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.
	Trash and debris	Trash and debris have accumulated on embankment.	Remove trash and debris from embankment.



## **APPENDIX G: KEY MAINTENANCE ACCOUNTABILITY PROCESS MANUAL EXCERPTS**



## ***Group 2 - Drainage Maintenance & Slope Repair***

### **2A1- Maintain Ditches**

Includes all work necessary to remove silt, soil and rock that have built up over time to restore the flow capacity of ditches. Work may include placing rock in ditches that have eroded to restore the original flow lines and control future erosion. Re-vegetation of the cleaned ditch may also be implemented to control future erosion. Material that is removed from the ditch must be hauled to a suitable disposal site. Crews doing this work may vary from 1 to more than 7 people depending on the size of the repair and amount of equipment needed to accomplish the work. Equipment may include dump trucks, front end loader, motor grader, belt loader, excavator, or backhoe.

### **2A2 - Maintain Culverts**

Includes all work necessary to keep culverts that cross state highways free of debris and silt. Also includes removing debris build-up, beaver dams, or brush at culvert ends to insure they are free of obstructions. Crews doing this work may vary from 2 to 4 people depending on the size of the obstruction. Equipment may include a culvert rodder, dump truck, backhoe, double drum dragline and hand tools.

### **2A3 - Maintain Catch Basins & Inlets**

Includes all work necessary to restore flow and storage capacity of inlets, catch basins, manholes, and connecting pipes. Work includes removing the lid and extracting built-up debris and silt. Crews doing this work may vary from 2 to 4 people depending on the amount of traffic control required. Equipment may include a vacuum truck, culvert rodder, water tank truck, dump truck, truck mounted attenuator, and hand tools.

### **2A4 - Maintain Stormwater Facilities**

Includes all work necessary to maintain the original functionality of stormwater facilities to meet WSDOT Highway Runoff Manual Chapter 5-5 requirements. This work may consist of removing soil/silt buildup from stormwater treatment/flow control facilities and inlet/outlet pipes. Material that is removed must be properly managed. Work may also involve erosion repair, liner repair, beaver dam removal, tree removal and noxious and nuisance weed control within the confines of the storm water facility. Crews doing this work may vary from 2 to more than 7 people, depending on the size of the repair and amount of equipment needed to accomplish the work. Equipment may include dump trucks, front end loader, excavator, backhoe, mowers, or herbicide sprayer.



## **2A5 - Slope Repair**

Includes all work necessary to repair slope damage from slides, drifting sand or erosion. Work also includes repairing damage to riprap, cribbing, bulkheads, and dikes. For slide repair, the rock, mud, or dirt that has slid into the ditch or on the roadway must be removed and the ditch returned to its original shape. Erosion repair will involve replacing the eroded material with rock, gravel or other material to stabilize the slope and restore it to its original shape. It may also require removing the eroded material if it has caused damage to adjoining land. Re-vegetation of the slope may also be implemented to control future slope damage. The crew size will vary greatly depending on the size of the slide or damage that has occurred and the amount of equipment needed to do the work. Equipment may include dump trucks, front end loader, excavator, or backhoe.

## ***Group 3 - Roadside & Vegetation Management***

### **3A1 - Litter Pickup**

Includes all work necessary to remove litter, debris, and dead animal carcasses from the shoulder and roadside, and haul it to an appropriate disposal site. Also includes administration of the Adopt-A-Highway Litter Control Program including providing safety hats and vests, signs, and litter sacks to the groups and collecting the filled sacks and hauling to an appropriate disposal site. Work requires one or two people with a small truck, dump truck or garbage compactor.

### **3A2 - Noxious Weed Control**

Includes all work necessary to eradicate and prevent the spread of seed from weeds identified in WAC 16-750 as a Class A or B noxious weed and growing on highway rights of way. The work may involve the spraying of herbicides, mowing, hand pulling, or application of biological control agents (bugs or diseases). The work also includes preventive strategies such as seeding, planting, fertilizing, or liming to enhance desirable vegetation communities which will out-compete unwanted weeds. Work is accomplished by one or two people using power spray equipment, or mowers. A buffer truck may be necessary for traffic control safety.



# III - DRAINAGE

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## A. DITCHES



<b>Units of Measure:</b>	Total linear feet of ditch, per 0.10-mile section. Total linear feet of filled ditch, per 0.10-mile section.
<b>Threshold:</b>	Count as deficient all ditches that are 50% or more full.
<b>Methodology:</b>	<p>Measure all ditches within the section and record the total linear feet of ditches. Measure and record the linear feet of ditch that is 50% or more full of sediment or other material.</p> <p>For purposes of this survey, to be considered a ditch the following conditions must exist:</p> <ol style="list-style-type: none"><li>1. Must be designed and constructed to carry water - not a natural swale, or</li><li>2. Must be maintained as a ditch by Maintenance.</li></ol>
<b>Comments:</b>	Streams adjacent to the roadway are not considered ditches. Standing water (tidal or non-tidal) in ditches is not a deficiency. Vegetation growing in the ditch is not a deficiency. Ditches functioning solely to capture rock fall shall not be considered a ditch for this survey.



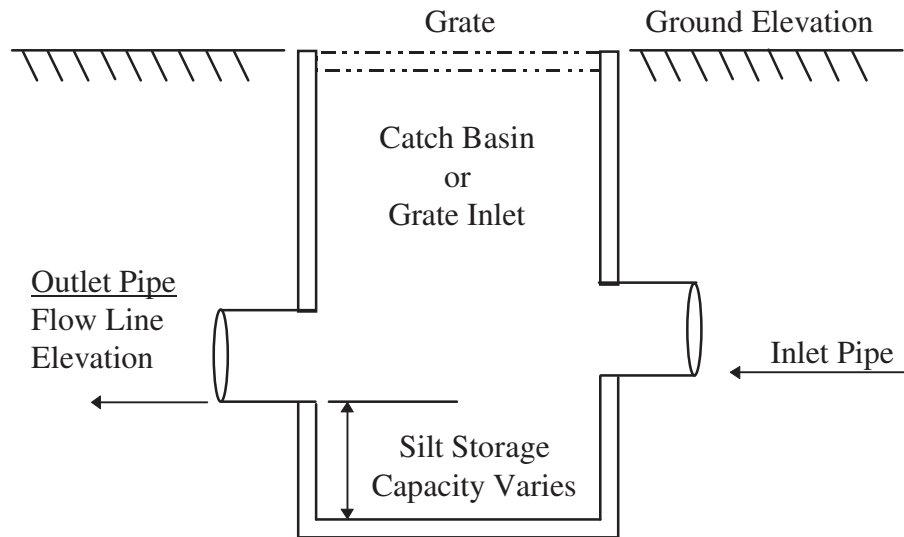
## B. CULVERTS



<b>Unit of Measure:</b>	Total number of culverts, per 0.10-mile section. Total number of culverts greater than or equal to 50% filled or otherwise deficient, per 0.10-mile section.
<b>Threshold:</b>	Count as deficient if: <ol style="list-style-type: none"><li>1. Any portion of the culvert is 50% or more filled with sediment or debris, or</li><li>2. Any end is significantly crushed or deformed, or</li><li>3. The volume of the inflow or outflow is reduced 50% or more by obstructions such as rocks, vegetation, or woody debris, or</li><li>4. The pipe is separated 1 in. or more, or damaged in a way that the function of the culvert is causing significant damage to the roadway prism or adjacent drainage channel.</li></ol>
<b>Methodology:</b>	Count and record all culverts within the section. Count and record any culvert that is 50% or greater filled or otherwise deficient. <b>Evaluate only those culverts that cross state highways or county roads at their intersection with state highways. Do not count culverts under private access roads.</b>
<b>Comments:</b>	Vegetation obscuring the end of a culvert is not a deficiency unless it obstructs the flow of water. Standing water (tidal or non-tidal) in ditches is not a deficiency. Culverts designed to be half filled with gravel for fish habitat should not be rated as deficient.



## C. CATCH BASINS / INLETS



**Units of Measure:**

Total number of catch basins and drain inlets, per 0.10-mile section. Total number of catch basins and drain inlets that are deficient.

**Threshold:**

Count as deficient any catch basin or drain inlet that has:

1. 50% or more of the inlet grate blocked with debris, or
2. The catch basin has sediment buildup that reaches or exceeds the flow line elevation of the outlet pipe.

**Methodology:**

Count and record the total number of catch basins and drain inlets in the section. Count and record the number of catch basins and drain inlets blocked by debris or catch basins filled with sediment.

**Comments:**

Both catch basins and drain inlets are rated for blockage of the inlet grate. Only catch basins are rated for sediment build-up. A flashlight and/or probe may be needed to determine if the structure is a catch basin (i.e., has silt storage capacity) and whether it is deficient.



## **APPENDIX H: FIBERGLASS REINFORCED PLASTIC PIPE (FRPP) BACKGROUND INFORMATION**



*Alternative Technical Concept ATKN-05  
Fiberglass Reinforced Plastic Pipe and  
Fittings*

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**I-405/SR 167 Interchange Direct  
Connector Project**

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Prepared by  
**Guy F. Atkinson Construction, LLC**

Contact: Philip Larson

February 26, 2016  
Rev 1 – March 23, 2016



## **Brief Description**

The use of painted ductile iron pipe for bridge drains presents some challenges regarding lifetime maintenance and the safety of our workforce. Currently, the best paint coating systems will provide at most 15 years of corrosion protection until requiring ongoing maintenance and touch up. This maintenance can be overlooked as a result of underfunding and the difficult nature of the access to maintain a suspended bridge drain. Given a lack of maintenance and a 75-year plus design life it can be anticipated that a complete recoating or replacement of a bridge drain system is likely well before a structure replacement. The access challenges of working under a bridge at heights makes both the initial installation and subsequent replacements a high risk for fall hazards and strains.

New technology in the development of fiber reinforced plastic (FRPP) bridge drain pipe allows a solution that virtually eliminates any maintenance for the life of the structure and simplifies installation dramatically by reducing the weight of the pipe by a factor of over 10 to 1.

FRPP bridge drains will outperform ductile iron pipe during construction, and at every phase of development through the I-405 Master Plan, in every way including:

- **Corrosion resistance** – There is no corrosion with a fiberglass bridge drain system. FRPP is inert to oil, gas, road salt, ice melting solutions and many other corrosive chemicals.
- **Ease of installation** – Worker safety will increase dramatically as the weight of materials are reduced by a factor of ten. This is compounded by the elimination of maintenance work over the bridges life span.
- **Aesthetically** – The FRPP pipe is dyed to match the desired color throughout its thickness. Nicks or scratches to dot require touchup and do not lead to the degradation of the pipe aesthetics over time.

Any perceived risks associated with this new technology are quickly eliminated when you examine how WSDOT has successfully used FRP as a replacement to steel for these same reasons on a majority stairways and access platforms in corrosive environments such as the Tacoma Narrows Bridge and inside recent floating bridge pontoons. In addition FRP Pipe was just recently used for bridge drains on the SR 520 floating bridge.



### **Detailed Description**

This ATC would allow the use of Fiberglass Reinforced Plastic Pipe and Fittings (FRPP) for bridge drainage pipe. FRPP bridge drains are equal to or better than ductile iron pipe during construction, and at every phase of development through the I-405 Master Plan. The following is a detailed listing of the superior properties and benefits of FRPP pipe:

- FRPP is fabricated with pigmented resin throughout the wall rather than painting.
- The color can be custom matched in the factory to bridge structure and project aesthetics as required by the RFP.
- Eliminates the labor and safety risk required to paint after installation.
- Reduces the schedule related to drainage pipe installation.
- Eliminates long-term maintenance by eliminating repainting requirements.
- Lighter weight than steel with similar hanger spacing requirements.
- Easier and safer to transport and handle prior to installation than steel pipe.
- Reduced individual hanger loading and total structural loading.
- Equal or lower Manning's value than steel.
- Inert to water, oil, gas, road salt, and ice melting solutions.
- Eliminates maintenance requirements due to pipe corrosion.
- FRPP is resistant to UV degradation.
- Fittings, directional changes and cleanouts can be fabricated into pipe, reducing labor and schedule required for installation.
- FRPP will not actively feed a fire, nor will it melt when exposed to open flames. It is available with a flame spread rating from 10 to 75.

We have included the attached materials data sheets and supplier literature following the body of the ATC for further documentation of the specifications and benefits of FRPP.



## **Usage**

This ATC would be used for drainage conveyance piping on the Direct Connector between SR 167 and I-405 along with any I-405 mainline and ramp bridges.

## **Subsurface investigations**

No additional subsurface investigation is required.

## **Proposed RFP Modifications**

Request to add Fiberglass Reinforced Plastic Pipe, with pigmented resin to match structural color requirements, to the allowable materials for Bridge Deck Drainage specified in RFP Section 2.13.4.4.1. Specifically add a new bullet after line 27 on page 2.13-12 that states, “The use of Fiberglass Reinforced Plastic Pipe, with pigmented resin to match structural color requirements, is allowed.”

## **Design Deviations**

No design deviations are required by this ATC

## **Analysis**

Using the design approach outlined in this ATC we are exceeding the project goals and the Project’s finished results.

- a) Functionality – *Functionality remains the same, no additional traffic operational analysis required.*
- b) Structural adequacy – *Reduces structural loading requirements for pipe hangers. Reduces total weight of pipe transferred to the bridge structure.*
- c) Safety- *A significantly lighter weight material than steel, so it is easier and safer for workers to suspend from an elevated structure during initial installation and replacement. Eliminates or reduces safety hazard of replacing corroded pipes suspended from the elevated bridge structure. Eliminates the safety hazard of repainting pipes suspended from the elevated bridge structure.*
- d) The Project Goals –
  - a. Project Management: Collaboration - *This ATC demonstrates our commitment to meet or exceed the RFP requirements. By allowing the use of FRPP for bridge drainage we are reducing impacts: to the adjacent community and to long-term maintenance operations. It is through excellent project management and collaboration with WSDOT that we are able to exceed the delivered project finished result.*



- b. Minimize Impacts: Community - *This ATC reduces the construction duration the local community will be subject to the adjacent construction.*
  - c. Project Management: Quality - *This ATC demonstrates our commitment to meet or exceed the RFP requirements. By installing FRPP for bridge drainage it reduces number of bridge hangers, allows for integrated fittings, and is factory pigment dyed. These benefits reduce potential for quality defects and ensure a quality finished product.*
  - d. Minimize Impacts: Traffic - *This ATC reduces construction duration without requiring additional ramp or mainline closures.*
  - e. Environmental Compliance – *No change from the RFP.*
  - f. Minimize Footprint – *No change from the RFP.*
- e) Comparison of life cycle costs including repair and maintenance – *Decreases cost of initial installation. Decreases or eliminates costs to replace corroded pipes. Eliminates cost of pipe repainting. Given the long design life of the direct connect structure, the magnitude of the savings realized by elimination of any coating maintenance and replacement is expected to be over \$250,000 in 2016 dollars. Following are critical life cycle characteristics of FRPP:*
- **Fire Resistance**  
*FRP is inherently more fire resistance than most other plastic pipes. Unlike thermoplastic pipes, like PVC or HDPE, the raw materials of the FRP pipe can never be extracted from the final product. This means that the FRP pipe will not melt but instead char if exposed to an open flame. Another key factor in the rating would be whether or not it feeds the fire once exposed. The FRP will not actively feed the fire, if the pipe is exposed to an open flame then once this flame is removed the FRP will not continue to burn.*
  - **UV Resistance**  
*On its own, a pure vinyl ester resin would be susceptible to the degradation caused by long term UV exposure. The extent of this sustained damage however is primarily of cosmetic concern. The degradation of the pipe is isolated to the surface of the material and does little to effect the structural integrity of the product, let alone make the product more brittle. Essentially the UV rays break down the surface layer of the vinyl ester resin and as a result the outer most layer of reinforcing glass starts to become exposed. This phenomena is commonly referred to as fiber blooming. It is clear why the extent of*



*this degradation is limited to the surface as the reinforcing glass fibers themselves are immune to the exposure of UV rays. Once these glass fibers are exposed the UV rays no longer have a material to attack.*

*Even though these concerns remain cosmetic in nature FRPP is manufactured with steps to combat this issue and ensure a long term aesthetically pleasing drainage system. The pipes have been engineered with a custom blend of vinyl ester resin to include a UV inhibitor. Like the custom pigmentations, the UV inhibitor is added to the raw resin before manufacturing takes place therefore it is present throughout the total wall thickness of the pipe & fittings. Still this custom resin blend is only the first step of a two-step process to which we also place an additional UV inhibiting top coat to the finished products. This product has been tried to the ASTM G 154 long term UV exposure testing procedures with great success (report attached).*

- **Corrosion & Chemical Resistance**

*There is no corrosion with a fiberglass bridge drain system. Fiberglass is inert to oil, gas, salt, ice-melting solutions and many other corrosive compounds found on highway structures. Even cleanouts and roadway scuppers are nonmetallic, resulting in a system that will never require replacement due to a corrosion-related failure. Essentially, the FRPP will not be effected by any type of spill that could be anticipated for a bridge drain application.*

- f) *Aesthetics – Pigmented pipe eliminates chipping and wear of painted surfaces, maintaining a consistent color throughout its life cycle. The raw resins used in manufacturing are impregnated with the pigments before manufacturing takes place. This allows for a full depth pigmentation, from ID to OD of the product, and eliminates the need for surface paints in order to match custom colors. The bonding adhesive used to assemble the pipe is also pigmented to match the pipe.*
- g) *Impacts on Construction traffic – There would be no adverse effects on construction traffic to implement this ATC*
- h) *Effect on or changes to environmental commitments identified in the RFP - There would be no effect or change to the environmental commitments to implement this ATC.*
- i) *Impacts to Surrounding and Adjacent Communities - This ATC will not impact surrounding and adjacent communities*
- j) *Changes needed in the location, length, height, or number of noise walls – No noise wall changes are required for implementation of ATC # 05.*



- k) Impact on Utilities and Rail - *No utility or rail impacts are required for implementation of ATC # 05*
- l) Discussion of additional right-of-way or easements required - *No additional ROW or Easements are required for implementation of ATC # 05*

**Forward Compatibility**

This ATC will have no impacts to forward compatibility.

**Attachments**

*Manufacturer material information.*





# FRP Bridge Drain Pipe

Perfecting Bridge Drain Systems for More Than 30 Years



## Features

### Corrosion Resistant



Providing our clients with a no-rust, no-rot pipe is one of our most basic benefits. There is no corrosion with a fiberglass bridge drain system. Fiberglass is inert to oil, gas, salt, ice-melting solutions and many other corrosive compounds found on highway structures. Even cleanouts and roadway scuppers are nonmetallic, resulting in a system that will never require replacement due to a corrosion-related failure.

### Lightweight



Fiberglass drain piping can be up to 10 times lighter than equivalent metallic systems. This allows the installer to reduce the crew sizes required on-site as just one laborer can handle full sticks of pipe and fittings. Even though the material is light, the mechanical properties of fiberglass still fall more closely in line with steel products rather than weaker thermoplastics like PVC.

### Easy Installation



A major advantage of a fiberglass drain system lies in its prefabrication capabilities. On-site deliveries can easily include preassembled joints, collectors, cleanouts and even directional changes. This option saves a lot of time and energy for the contractor in the field, which will ultimately save money. The lightweight nature of fiberglass also limits the need for heavy machinery used to handle the materials, decreasing installation costs even further.

### Custom Fabrication



If you can draw it, we can build it. Custom and specific fittings are easily fabricated by our American manufacturer – they have been doing so since 1984! This includes any specialty items such as catch basins or hoppers, odd degree elbows, oval fittings, square and even rectangular components. We can also make any combination of these items to ensure the drainage system we install is as unique as the bridge it serves.

## Case Histories

### Pulaski Skyway Rehab

#### Viaduct over the New Jersey Meadowlands

Grace Composites worked with the installing contractor to design and develop nearly 35,000 linear feet of prefabricated pipe spools. This partnership ensured the project was completed within budget and ahead of schedule.



### Centennial Bridge

#### Crosses the Missouri River in Leavenworth, KS

While engineers planned the bridge deck drain replacements for this retrofit project, they searched for other bridge components that could benefit from an FRP alternative design. In all, 56 custom fiberglass girder inspection door hatch covers were installed.



### Benjamin Franklin Bridge

#### Crosses the Delaware River in Philadelphia, PA

Our previous success with the Commodore Barry Bridge led to this project, our second opportunity to team up with the Delaware River Port Authority. All pipe and fittings supplied for the project were matched to Benjamin Franklin Blue per the contract requirements.



## Fittings, Troughs & Accessories

Fiberglass bridge drain projects require fittings, scuppers, expansion joints and related accessories. Fittings are pigmented to match pipe and/or existing colors. Any color from the federal 595 color chart can be matched. Standard and custom fittings are available to fit most any bridge drain pipe configuration. Cleanouts can also be added to any fitting type to improve the long-term maintenance of the system. A white PVC removable plug is included at each cleanout location but other options are available if desired.

The FRP components we offer engineers only begin with the pipe and fittings. Girder inspection manhole covers, bearing catchments, rectangular pipe and even bird or other pest control items can be manufactured using fiberglass reinforced plastics.





View more detailed case histories here!

## Chicago Skyway

**Crosses the Calumet River and Calumet Harbor in Chicago, IL**

Despite being one of our first mega projects, the installation of the Chicago Skyway's drainage system was completed by two workers and a manlift. The overall system design consisted of nearly 15,000 linear feet of pipe and hundreds of custom fittings.



## Joe Montana Skyway

**Pennsylvania Turnpike 43  
South of Pittsburgh, PA**

The FRP bridge drain pipe system's range of custom colors allowed engineers to blend pipes with the bridge's color scheme. The bridge's extreme elevation reaches more than 200 feet in some places.



## Chapel Lane Extension

**Trough drains for I-459 structure in Hoover, AL**

When extending Chapel Lane, the Alabama DOT needed to control the interaction between the new and existing roadways. Limited by the design of the I-459 drainage layout, 400 linear feet of fiberglass troughs were installed to help improve safety for new roadway users.



## Peace Bridge

**Crosses the Niagara River in Buffalo, NY**

With operational responsibilities shared by the New York DOT and the Ontario MTO, the use of fiberglass drain products required joint approval. A series of roller hangers were used to help speed up installation times by allowing contractors to push and pull the pipe through the supports while maintaining a static location for pipe assembly.



## Huey P. Long Bridge

**Crosses the Mississippi River west of New Orleans, LA**

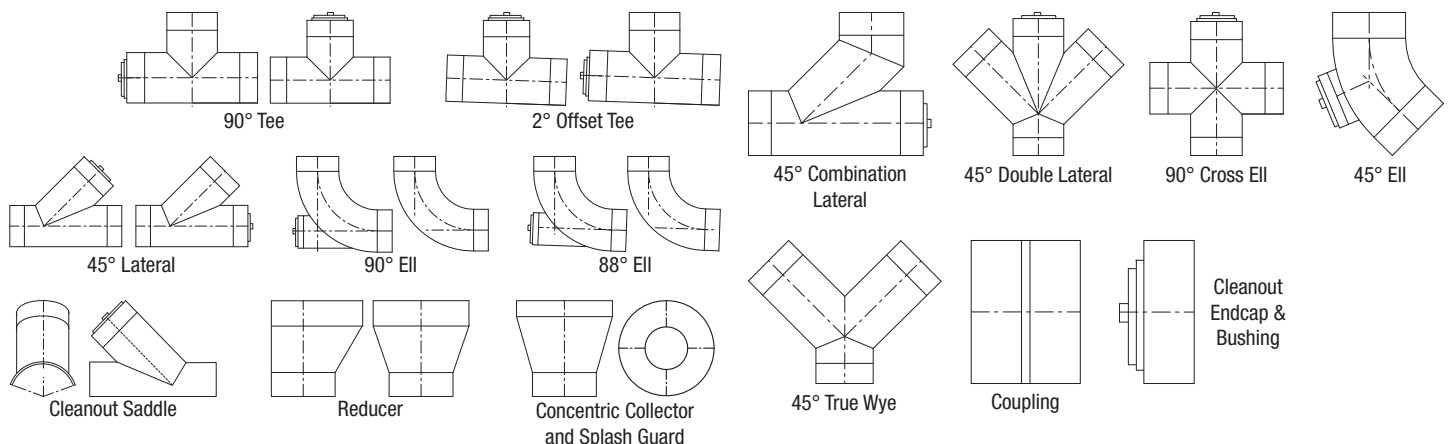
The Huey P. Long Bridge opened in 1935 as New Orleans' first Mississippi River crossing. By 2012, wear and tear forced engineers to make heavy investments toward rehab for the structure, with the inclusion of a new fiberglass drainage system being a part of their overall scope. That same year, the structure was declared by the ASCE as a National Civil Engineering Monument.



## New River Gorge Bridge

**Crosses the New River in Fayette County West Virginia**

As one of the tallest vehicular bridges in the world, this structure attracts nearly 100,000 guests for the Fayette County Bridge Days each year. When de-icing salts began to accelerate pack rusting at the deck joints, WVDOT engineers not only invested in the rehab of rusty components but also addressed the cause of the corrosion by installing a full capture FRP drain system.





## Technical Data

### FRP Pipe

Bridge and highway piping is filament wound composite pipe consisting of a thermosetting resin and continuous glass filament structural reinforcement. It is available in standard sizes of 4-24 inches. Larger sizes are available upon request.

### Joining Methods

An adhesive bonded socket joint is the primary joining method for FRP bridge drain pipe. All other typical joining methods are available.



View the installation video!

### Dimensional Data

Nominal Size		Nominal I.D.		Nominal O.D.		Nominal Coupling O.D.		Average Wall Thickness		Support Spacing @0.5" Deflection		Nominal Weight	
(in.)	(mm)	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)	(ft.)	(m)	(lbs./ft.)	(kg/m)
4	100	4.00	101	4.25	108	4.34	110	.125	3.2	16.5	5.0	1.3	1.9
6	120	6.35	160	6.60	168	6.94	176	.125	3.2	18.3	5.6	2.0	3.0
8	200	8.23	208	8.48	215	8.82	224	.125	3.2	20.2	6.2	2.6	3.9
10	250	10.23	259	10.48	266	10.82	275	.125	3.2	21.3	6.5	3.6	5.4
12	300	12.23	309	12.48	317	12.82	326	.125	3.2	22.4	6.8	4.4	6.6
14	350	14.23	360	14.48	368	14.82	376	.125	3.2	23.2	7.1	5.0	7.4
16	400	16.23	411	16.48	419	16.82	427	.125	3.2	24.0	7.3	5.7	8.5
18	450	18.23	462	18.48	469	18.82	478	.125	3.2	24.8	7.6	6.9	10.3
20	500	20.23	514	20.56	522	20.90	531	.165	4.2	25.7	7.8	8.3	12.3
24	600	24.23	615	24.56	624	24.90	632	.165	4.2	26.7	8.2	9.9	14.6

\* All values are nominal, tolerances or maximum/minimum limits can be obtained from the manufacturer: Grace Composites, 351 Ruth Road, Lonoke, AR 72086, Phone: 501-676-9505, Fax: 501-676-9515, E-mail: jeff@gracecomposites.com. A copy of the standard specifications are available for download at [www.frbbridgedrainpipe.com](http://www.frbbridgedrainpipe.com).

### Pipe Material Comparisons

	Fiberglass	PVC	Steel
Weight/Foot	3.6#	11.7#	40.5#
Minimum Support Spacing	21.3'	7.0'	22.0'
Expansion/Contraction	1.18"	2.52"	.5"
Ultraviolet Degradation	UV inhibitors present in standard products	Very susceptible to UV degradation	Not susceptible to UV degradation
Resistance to Salt	Good	Good	Poor, unless stainless or galvanized steel
Resistance to Solvents	Good	Poor	Poor, unless stainless or galvanized steel
Resistance to Acids	Good	Good	Poor, unless stainless or galvanized steel
Resistance to Gasoline	Good	Poor	Poor, unless stainless or galvanized steel
Custom Colors	No paint required	Requires paint	Requires paint
Custom Bridge Drain Fittings	Available and easily fabricated	Not available	Not available

Note: Above conditions are based on using 10" diameter pipe. Expansion/contraction calculated using a 70 degree change in temperature per 100 foot of pipe.



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Made in the USA



## Accelerated Weathering of Bridge Drain Pipe and Fittings Using Fluorescent UV-B Light

Rusty Fortner May 27, 2003

### Introduction

The purpose of this study was to observe the effects of weathering on Bridge Drain Pipe and Fittings. An accelerated weathering tester was used to simulate the damaging effects of UV-B light. The sample was exposed to alternating periods of intense UV-B light and condensation, and periodically removed for visual inspection. The specimen successfully endured 6 weeks of accelerated weathering. (Equivalent to approximately 2 years of outdoor exposure)

### Test Specimen

The test specimen was a 3" X 6" X 1/8" section of contact molded laminate. This sample is exactly like the exterior of Bridge Drain Fittings and representative of the exterior of Bridge Drain Pipe, having an identical resin system containing pigments, wax and UV-Inhibitors.

### Equipment

A QUV Accelerated weathering tester was used to simulate the effects of UV-B light and condensations. The exposure temperature and cycle durations were automatically controlled. The accelerated weathering tester was operated with UVB-313 lamps. These lamps have a peak emission of 313 nm.

### Procedure

The test was based on ASTM D 4329-99. The specimen was continuously exposed according to the following cycles: 4 hours of UV-B at 60 deg. C. followed by 4 hours of condensation at 50 deg. C. The cycles were repeated continuously. After every 400 hours of operation the oldest lamp was replaced and all lamps rotated. The specimen was not rotated during the test. The sample was periodically removed for visual inspection.

### Observation

After the specimen was continuously exposed for 6 weeks, the equivalent of approximately 2 years of outdoor exposure, the specimen appeared almost unchanged. The specimen lost very little of its gloss. There was some yellowing, that was not apparent unless the specimen was placed next to a control sample. There was no visible fiber blooming or exposed fibers.

### Interpretation

Due to the variability and complexity of the outdoor environment, it is not possible to have a single specimen accurately predict the life expectancy of product. The relationship between accelerated weathering exposure and outdoor exposure depends on many variables including the geography, altitude, season variations, random year-to-year variations in the same location and orientation of samples. These variables cause degradation to vary greatly and unpredictably. Despite the impossibility of a long term predictions factor, we can state that for the duration of this test there was little effect on the specimen caused from its exposure to UV-B light and condensation as present in the accelerated weathering tester.

### Reference:

ASTM D 4329-99 Standard Practice for Fluorescent UV Exposure of Plastics  
ASTM G 154 Standard Practice for Operating Fluorescent Light Apparatus UV Exposure of Nonmetallic Materials  
QUV Accelerated Weathering Tester Operating Manual



# FIBERGLASS BRIDGE DRAIN PIPE SYSTEM SPECIFICATIONS

## 1. FIBERGLASS PIPES AND FITTINGS

- A. Drainage pipes and related fittings shall be a reinforced thermosetting resin pipe system meeting the requirements of ASTM D 2996, **BDP-12EA12122**, with at least 30,000 psi short time rupture strength hoops tensile stress, and the accelerated UV weathering performance requirements of ASTM G154 (D4329-99)
- B. All elbows shall be manufactured by using smooth radius steel molds. Elbow shall not be mitered. Filament wound pipe may be used for tees, laterals and crosses.
- C. All fiberglass pipes and fittings shall be pigmented resin throughout the wall. Color to be standard concrete-gray or designated color. Paint, gel-coat or exterior coating will not be accepted.
- D. A minimum liner of 40-mil resin-rich 1-1/2 ounce glass mat shall be standard for all elbows.
- E. Adhesive for bond joint shall be a vinyl ester resin based product with silica filler, polyester pigment, and methyl ethyl ketone peroxide catalyst. The adhesive formulation shall be certified to be proven suitable for the intended application. The resin shall be certified to have no additives that leach out, catalysts that remain active, or other ingredients that could lead to deterioration.
- F. The minimum total wall thickness shall be no less than listed on chart below.

Nominal Size		Wall Thickness	
(In.)	(mm)	(In.)	(mm)
4	100	.125	3.18
6	150	.125	3.18
8	200	.125	3.18
10	250	.125	3.18
12	300	.125	3.18
14	350	.125	3.18
16	400	.125	3.18
18	450	.125	3.18



- G. Where specifically shown as cleanout on runs of pipe and fittings; the removal shall be made with a threaded PVC plug.
- H. Adhesive bond joints are acceptable for all joints. Straight runs may use a tee or a reducing saddle bonded to the pipe. Cleanouts shall use a 45-degree reducing saddle bonded to the pipe. No other branch method, such as stab-in and overlay, shall be allowed. Straight sockets shall be used for ease of installation with adhesive joint system.
- I. The end run connection may feature a nominal 6-inch female threaded fiberglass outlet. The female outlet shall be filled with a male threaded PVC plug.
- J. Runs of pipe shall be supported at spacing not greater than those shown on the drawings. Supports that have point contact or narrow supporting areas shall not be allowed. Standard sling, clamp, and clevis hangers for use with steel pipes shall be used. Supports shall have 120 degrees of contact with the pipe. If support would be less than 120 degrees of contact, a split fiberglass pipe protective sleeve shall be installed, bonded in place with adhesive. (Equal in length to the pipe diameter i.e. 6" Dia. pipe, 6" long split sleeve)
- K. Strap width shall be 1-1/2 inch for nominal fiberglass pipe size 6 inch to 10 inch, and 2 inch for nominal fiberglass pipe size 12 inch to 14 inch. Hanger's thickness shall be 3/16 inch. (see chart below)

pipe size	min. strap width
3"	1-1/4"
4"	1-1/4"
6"	1-1/2"
8"	1-1/2"
10"	1-1/2"
12"	2"
14"	2"
16"	2-1/2"



- L. All fiberglass pipe, fittings, and expansion joints shall be handled and installed according to the guidelines and procedures recommended in the printed literature of the manufacturer. Pipe and fittings from same manufacturer.
- M. Connections to roadway drain scuppers shall not be rigid. The transition shall be made by means of a fiberglass collector assembly. The scupper outlet pipe, with the collector cover attached around it, shall be suspended into a 12 inch by 8 inch (unless otherwise shown) tapered collector.
- N. All products to be manufactured in U.S.A. and are available from Grace Composites at 501-676-9505 and Westfall Company, Inc. at 636-938-6313, [www.frpbridgedrainpipe.com](http://www.frpbridgedrainpipe.com)

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# **FIBERGLASS PIPE DRAIN SYSTEMS for ELEVATED HIGHWAYS, BRIDGE APPROACHES and BRIDGES**

By GARLAND R. WESTFALL

The I-70 interstate passes through busy downtown St. Louis, Missouri in view of the Gateway Arch. In the summer of 1986 a complete replacement drain system was installed to connect the scuppers and drains on the elevated I-70. The replacement program was to replace failing steel drains with reinforced thermal resin plastic (RTRP) drainpipe and fittings and to also paint the existing structures. The steel drains corroded due to high salt exposure and oil and gasoline droppings, to which the fiberglass is inert. This fiberglass drain installation was a first in the state of Missouri. The 1,320 feet of 10" pipe, 1,850 feet of 8" and a combination of 570 prefabricated and standard fittings were installed by two mechanics and a high school summer apprentice.

## **EASY INSTALLATION**

A major advantage of a fiberglass system during installation is its prefabrication capabilities. Directional changes, clean-out saddles and scupper collectors can be attached and fitted to sections of pipe then lifted into place. The light weight and high strength is a natural for this type of installation. Figure 1 show two men can carry 40 feet of 8" pipe, which has been fitted with two collectors, one clean-out and one coupling. The total weight of this pipe section, with fittings, is 120 pounds. A simple two-man lift can be used to place the pipe into pre-installed hangers.

The RTRP pipe and fittings are easily assembled and can be fabricated by any



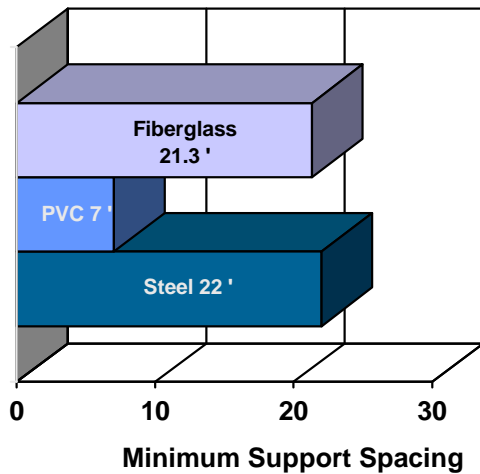
**Figure 1 – Two men carry 40' of 8" pipe in Topeka, Kansas**

competent contractor. No welding, brazing or soldering skills are required. The fundamentals of the adhesive bonded joints are easily learned. Contractors in the St. Louis area have been installing this type of pipe for more than twenty-five years.

## **DESIGN ADVANTAGES OF FIBERGLASS**

Fiberglass is classified as a thermoset resin material. Fiberglass drain systems provide many advantages over metal and thermoplastic piping systems (PVC and CPVC). In the ambient temperature range of highways, the RTRP will not experience extreme expansions during hot temperatures or brittleness during the extreme cold. As a result, the support spacing does not present the problems that are associated with thermoplastics and is compatible with metal systems. (See figure 2 for support spacing) Fiberglass has the advantage of being stronger, lighter in weight (see figure 3) and also has a higher impact resistance





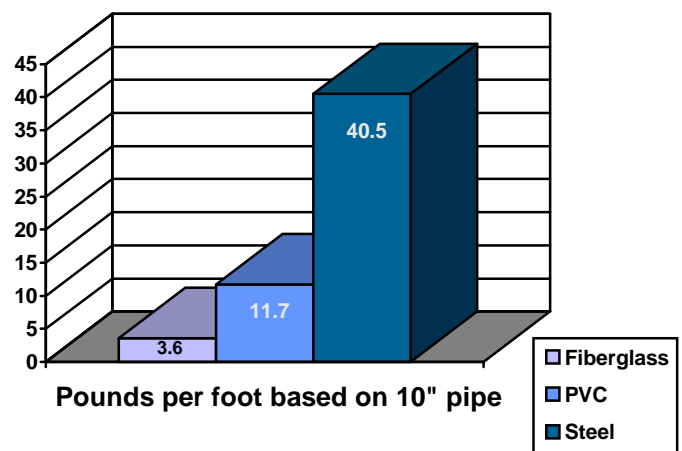
**Figure 2 – Support Spacing for 10” pipe**

than thermoplastics. Also, metal pipe is very heavy to handle and is a burden of weight on the structure. Metal pipe can experience corrosion both internally and externally. Normally the need for painting will occur. As mentioned, fiberglass pipe and fittings are now pigmented which eliminates the need for painting. Originally a fiberglass system was painted along with the structures. With the restriction of the V.O.C. of painting, pigmentation of the system was developed. This provides a shiny, slick finish that maintains a clean appearance and is U.V. resistant. Concrete Gray has become somewhat of a standard color for Illinois, Missouri and Kansas.

## DESIGN FLEXIBILITY

Development of our fiberglass bridge system has occurred over the years with input from the Illinois, Missouri and Kansas Departments of Transportation.

Due to corrosion, removal of nuts and bolts from flanges on drain clean-outs was always a difficult task. That is now solved by installing a nonmetallic female thread in the fitting and inserting a threaded PVC plug. A clean-out saddle on a 45-degree angle provides clean-outs on the straight runs. The drains off the scupper are caught with a collector fitting. This collector acts as a funnel that allows several features. It reduces the vibration from the deck, allows for expansion and contraction, and provides a contractor a certain amount of plumbing flexibility. No splash-out is allowed because a floating fiberglass washer is used to cover the approximate 1-1/2 inch or space around the top. This collection design is perfect for retrofit, where a fitting is not available due to corrosion.



**Figure 3 – Fiberglass Weight Advantage**

An “all fiberglass” expansion joint will allow several inches of “water-tight” movement. Anchors are utilized with the expansion joints to provide a total



engineered system. This takes into consideration expansion and contraction to span the seasons. An expansion joint fitting was developed for the Calumet Skyway in Chicago (7,000 feet of 8" to 18") and the Southwest Trafficway I-35 in Kansas City, Missouri (5,000 feet of 8"). Figure 4 shows where two men are hanging 30 feet of 16-inch pipe, 95 feet above ground level.

**Figure 4 – Chicago Skyway**



## **CONCLUSION**

A recent article in the June, 1996 publication of the American Automobile Association titled "America's Aging Highways and Airways," states that of the 570,000 highway bridges; twenty-five percent of those bridges are rated as "structurally deficient" or "functionally obsolete." A Westfall Company, Inc. survey indicates that many structures, both concrete and steel, are damaged due to failing drains. RTRP is the practical solution for the drain systems.

By: Garland R. Westfall

### **About the Author:**

Founded Westfall Company, Inc. in 1972. He holds a double major in Math and Physics. He is co-author of an ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.) paper titled "The Use of Fiberglass Piping Systems in a District Cooling Application." Garland has been a distributor of fiberglass pipe since 1972, was a Piping Engineer at Monsanto, Queeny Plant, in St. Louis, Missouri from 1967 to 1971.

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## **ENHANCED SERVICE LIFE USING FRP BRIDGE DRAIN PIPE, SCUPPERS AND TROUGHS**

Alan R. Westfall, Westfall Company, Inc., (636) 938-3113, [awestfall@westfallcompany.com](mailto:awestfall@westfallcompany.com)

### **ABSTRACT**

Corrosion of bridges presents a costly, dangerous and unsightly situation. The use of FRP (fiberglass reinforced plastic) drains, scuppers and troughs eliminates the corrosion found on existing bridges and is ideal for new construction. FRP bridge drain pipe scuppers and troughs are a lightweight, corrosion resistant alternative to traditional metal products. The thermosetting properties of FRP offer tremendous strength and impact resistance over thermoplastic products such as PVC.

FRP pipe is manufactured by the filament winding process. This process provides the maximum physical strength in both the hoop and transverse directions, thus allowing support spans equal to and greater than metallic systems. The fittings are custom molded with accessories available such as cleanouts. The UV pigment is blended in the resin providing a monolithic color.

Installation of FRP pipe is a bonding method using high-strength thermosetting resin. The pipe and fittings are a socket system requiring only several hours of training to become proficient at installation. The lightweight product is easily handled by installers without the use of heavy lifting equipment.

FRP bridge drain piping and accessories were first introduced in the early 1980's to the Illinois Department of Transportation to help eliminate corrosion and provide a lightweight alternative to a project in downtown Chicago. The project's success has lead to hundreds of applications in over 30 states.



## HISTORY

Two leaders in the industry for solving problems related to corrosion are Garland Westfall of Westfall Company, Inc. St. Louis, and Jeff Foster of Grace Composites of Lonoke, Arkansas. Over the last twenty plus years, these two have combined their skills in manufacturing, marketing and engineering to develop a lightweight, corrosion resistant, low maintenance and easy to install bridge drain system.

The first bridge drain pipe (BDP) project was completed in the early 1980's. The Chief Bridge Engineer for the Illinois Department of Transportation (IDOT) read an advertisement about corrosion resistant reinforced thermosetting resin pipe – known to most as FRP (fiberglass reinforced plastic). He contacted Garland Westfall to see if this product, normally used for chemical and water applications, could be modified for runoff water for a small bridge project in Chicago, Illinois. After several meetings, it was decided that the A.O. Smith Fiberglass Red Thread® II pipe (now Fiber Glass Systems) and standard pressure fittings could be used for the project. This first project had favorable results and received praise from the contractor and IDOT. The Chief Engineer for IDOT realized this product could solve his corrosion and stress problems due to heavy metal pipe currently being used on bridges and overpasses. This led to several other BDP projects over the next few years.

The Red Thread II pipe was prepped for accepting color pigmentation, but meeting the DOT standards for weathering and color presented a problem. The pigment did not adhere to the pipe as expected. The source for the FRP pipe supplied from A.O. Smith Fiberglass Pipe was problematic because their factories were designed to mass produce standard pipe and fittings. Westfall Company, Inc. had a relationship with a firm in Little Rock, Arkansas called FMN Industries. Jeff Foster, who now owns Grace Composites, was a lead designer and Manager for FMN. With input from Garland Westfall and Jeff Foster, a lightweight filament wound bridge drain pipe was developed with DOT approved color pigmentation throughout. In addition, matching fittings and accessories were developed.

The Missouri Department of Transportation (MODOT) visited the Chicago bridge site and admired the FRP bridge drain project. MODOT specified the FRP bridge drain pipe for a very large project on Interstate 70 next to the Gateway Arch in downtown St. Louis. The design called for non-standard pipe fittings, as well as scuppers, cleanouts and other unique equipment. This project was completed in 1984 and still looks like new today. This led to FRP Bridge Drain Pipe becoming a standard for MODOT, and many projects can be witnessed on Missouri's major interstates.



**Figure 1 - Interstate 70 St. Louis, MO**

The FRP Bridge Drain Pipe market was up and running. Over the course of a few years, seminars were conducted at 26 state level Departments of Transportation. Our participation in major bridge conferences as an exhibitor and speaker, has helped boost the presence of the product.

In 2001, due to the high demand and requirements for delivery, all production was moved to Grace Composites of Lonoke, Arkansas (near Little Rock, AR). Grace Composites proved their desire to join forces with Westfall Company, Inc. in manufacturing and developing the BDP market. FRP Bridge Drain Pipe has been installed in most states in the United States, as well as many locations in Canada.



## MANUFACTURING

Fiberglass bridge drain pipe is manufactured by the filament winding process. Filament winding requires a spinning mandrel where resin impregnated “E” glass fibers are wound in a predetermined pattern under controlled tension. Repeated passes create a strong layered product of a desired thickness. This process is controlled to produce approximately 75% glass reinforcement, which provides optimal physical strength, stiffness and internal pressure.

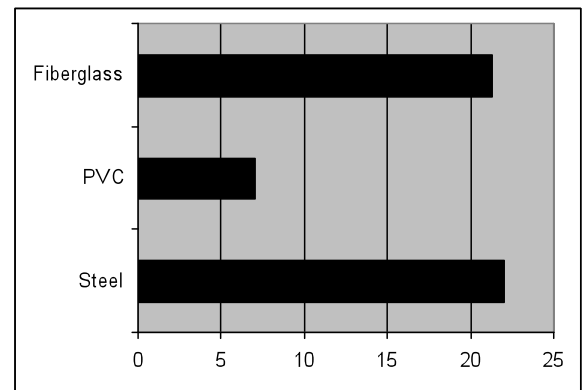
Fittings are manufactured by the hand-lay-up process. This involves a mold resembling the finished product on which glass saturated with resin is layered upon until the desired thickness is achieved. Bridge drainage presents a unique challenge since many angles are custom. In addition to odd angles, cleanouts are incorporated into many fittings presenting challenges for production. Troughs, expansion joints and scuppers are made specifically for the design of the bridge drain projects. Pigment is incorporated into the resin to provide color per DOT specifications.

Bridge drain pipe is designed to meet or exceed ASTM specifications D2996 and the accelerated UV weathering performance requirements in ASTM D4329-99 per procedure ASTM G154.

## DESIGN ADVANTAGES OF FRP

Fiberglass is classified as a thermoset resin material which means once the resin is cured, it can not be melted back to its original state. This property, coupled with high-strength fiberglass gives FRP advantages over metallic systems and differentiates itself from thermoplastics, such as PVC. Fiberglass bridge drain pipe and fittings do not become brittle with cold temperatures. In fact, the impact resistance and physical properties increase as the temperature drops (down to - 70° F).

Support spacing for FRP bridge drain pipe does not present the problems associated with thermoplastics and is compatible with metal systems. (See figure 2 for support spacing) FRP has the advantage of being stronger, lighter in weight and also has higher impact resistance than thermoplastic. The lightweight properties compared to metal systems are dramatic. 10” FRP weighs just 3.6 pounds per foot compared to many metal systems which weigh in at 40 pounds per foot.



**Figure 2 – Support Spacing in feet for 10” Pipe**

## DESIGN FLEXIBILITY

Development of FRP bridge drain systems has occurred over the years with input from Illinois, Missouri and Kansas Departments of Transportation. Due to corrosion, removal of nuts and bolts from flanges on drain cleanouts was a challenging task. Non-metallic cleanout female threads are now used, eliminating the rusting of traditional metal. Cleanouts on a 45° saddle provides easy cleanout access on a straight run. The drainage off the scupper is caught with a collector fitting. This collector acts as a funnel that reduces vibration from the deck and allows for expansion and contraction, as well as plumbing flexibility. A no splash-out is achieved because of the use of a floating fiberglass washer.

An all fiberglass expansion joint will allow several inches of water-tight movement. Anchors are utilized with the expansion joints to provide a total engineered system.



## EASY INSTALLATION

A major advantage to using fiberglass systems during installation is its prefabrication capabilities. Directional changes, cleanout saddles and scupper collectors can be attached and fitted to sections of pipe and then lifted into place. The lightweight and high strength properties are a



natural for this type of installation. Figure 3 shows two men can carry 40 feet of 8" pipe which has been fitted with two collectors, one cleanout and one coupling. The total weight of this pipe section, with fittings, is 120 pounds. A simple two-man lift can be used to place the pipe into pre-installed hangers.

The FRP pipe and fittings are easily assembled and can be fabricated by any competent contractor. No welding, brazing or soldering skills are required. The fundamentals of the adhesive bonded joints are easily learned. Contractors in the St. Louis area have been installing this type of pipe for more than 30 years.

**Figure 3 – Two men carry 40' of 8" pipe in Topeka, Kansas**

## CONCLUSION

A proper FRP pipe designed system can satisfy support spacing equal to a metallic system. With the lighter weight burden on the structural, as well as advantage on installation cost, FRP pipe has proven its attraction as a material of excellent choice. Installation in over 30 states has been recorded with growing interest with consulting engineers and DOT's. Several high profile projects have used fiberglass for their deck drains. These project sizes have varied from 6" thru 30", such as the Commonwealth Of Virginia Department Of Transportation's bridge on Route 58 over the John H. Kerr Reservoir.

With Americas aging highways and bridges, the use of a lightweight, corrosion resistant, long lasting and easy to install system, makes sense for bridge drainage, scuppers, troughs and downspouts. More information can be found at [www.frbidgedrainpipe.com](http://www.frbidgedrainpipe.com).



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